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U.S. Department of the Interior
Bureau of Land Management

Eugene District Office
Coast Range Resource Area
2890 Chad Drive
Eugene, Oregon 97408

October 2000

Long Tom Watershed Analysis

COMPLETED

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LONG TOM WATERSHED ANALYSIS

SEPTEMBER 2000

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This document was prepared according to the 1994-96 *Watershed Analysis Guidelines*. Based upon the information contained within this watershed analysis, it is our determination that the analysis contains sufficient information and adequate logic for BLM use in making decisions on project implementation based upon the requirements in the *Final Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Species Within the Range of the Northern Spotted Owl* (February 1994), and the *Eugene District Record of Decision/Resource Management Plan* (ROD/RMP), June 1995.

Accepted by:

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CHAPTER 1
Characterization

This chapter describes in a very general way the resources and issues within the Long Tom Watershed with particular emphasis on the foothill fringe. BLM lands make up about 8.4 percent of the watershed and are concentrated in the Coast Range foothills or "Valley Fringe". The Eugene District Resource Management Plan/EIS (November 1994) and Record of Decision (June 1995) provide a framework for management of Bureau lands within the watershed. The Northwest Forest Plan, otherwise known as the *Final Supplemental Environmental Impact Statement (SEIS) on Management of Habitat of Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (February 1994) and its *Record of Decision/Standards and Guidelines* (April 1994) amended the BLM RMPs. Together, these land use planning documents provide program implementation guidance and objectives/direction for the resource programs within various land use allocations identified in the plans.

Location and Communities

The Long Tom Watershed is located in the southern portion of the Willamette Valley, Oregon and within BLM's Coast Range and South Valley Resource Areas. BLM lands make up about 8.4 percent of the watershed and are concentrated in the Coast Range foothills or "Valley Fringe". The Valley Fringe makes up about 22.6 percent of the watershed (97,415 acres). It encompasses 262,749 acres and the smaller communities of Veneta (pop. 2,950), Junction City (pop. 4,400), Monroe (pop. 555), Harrisburg (pop. 2,535), and Coburg (pop. 790). Most of the watershed is on private lands. Mainly surrounded by farmlands the residents prefer the smaller town atmosphere and living in the rural area. Several of these towns hold festivals during the year to celebrate their community and attract business from outsiders. (Population figures are from November 1998 statistics - Eugene Chamber of Commerce)

Eugene (pop. 133,460) is the major city in this watershed with all the entertainment and businesses of a major city, is culturally diverse, and growing in population each year. The rest of the valley continues to change with the conversion of farm land to rural residential areas. Eugene is an attractive place to live because of its location along the Willamette River, its close proximity to ocean beaches, mountains, and to the major metropolis of Portland. The University of Oregon and Lane Community College are located in Eugene and provide academic learning opportunities to the community as well as for the enrolled students.

GEOLOGY AND SOILS

The Long Tom Watershed's foothill fringe is underlain by the Flournoy/Tyee formation, a very thick sequence of rhythmically bedded, medium to fine-grained micaceous, feldspathic, lithic, or arkosic marine sandstone and micaceous carbonaceous siltstone. Where it is dominated by the more easily weathered siltstone and fine sandstone sequence, it forms deep, fine-textured, highly

/

productive soils. Where the more competent, massive sandstone/siltstone dominates it forms shallow to moderately deep, coarser textured, moderately productive soils. Site Index for the soils of the Long Tom Watershed's foothill fringe range from 120 to 180, but typically are around 145 to 155. The more productive soils are typically greater than 40 inches deep, reddish clay loams/clays with less than 15 percent gravel by volume. The less productive soils are usually 10 to 40 inches deep, brown loams, greater than 15 percent gravel by volume.

CULTURAL

Archaeological site surveys conducted during the past 30 years have identified numerous prehistoric archaeological sites along the lower reaches of the Long Tom River and its major tributaries where these streams flow out onto the floor of the Willamette Valley. These surveys, including those conducted on BLM administrated property during the past 20 years show a rapid decrease in the number of archaeological sites as one proceeds upstream and away from the Willamette Valley. Prehistoric site distribution in the Long Tom Watershed also appears to be linked to elevation with all but a few sites located at elevations below 500 feet above mean sea level. Because the majority of BLM administered land in the watershed is at some distance from the floor of the Willamette Valley, and lies at elevations above 500 feet, the potential for the discovery of prehistoric sites on BLM administered tracts in the watershed is low.

HYDROLOGY & GEOMORPHOLOGY

The Long Tom Watershed differs from other watersheds in the Eugene District as it contains urban and agricultural lands in addition to forested lands. There are 3 subwatersheds draining the fringe area. To the south is Coyote Creek and west from the Coast Range is the upper Long Tom River drainage. These two flow into Fern Ridge reservoir. North of this is Ferguson Creek that drains into the Long Tom below Fern Ridge Reservoir. Draining the urban area and the eastern part of the watershed are the Amazon Diversion canal and Amazon Creek.

Most of the watershed is below 1000 feet elevation. Precipitation is mostly rain, and rain on snow events are highly unlikely. Average monthly minimum temperatures are above freezing. Annual precipitation increases from east to west through the watershed ranging from a low of 40 inches per year south of Eugene to a high of 74 inches on the highest and western most points. The majority of the precipitation falls from November through March. Stream flow patterns are closely correlated with precipitation although peak flows occur slightly later in the year than peak precipitation. The greatest daily precipitation generally occurs in December and January. The probability of overland flow occurring in undisturbed forest soils is very low as the porosity of the soils is high relative to the hourly rainfall rates. In the urban portions of the watershed impermeable surfaces increase overland flow. The Long Tom Watershed assessment showed that agricultural land had low potential for peak flow enhancement (Thieman 2000).

The Fern Ridge dam is located about 12 miles west of Eugene. It is used for flood control and recreation. The full pool level is 116,800 acre-feet and the summer storage level is 93,900 acre-feet. There are approximately 1410 miles of streams in the watershed with 730 miles of these in the fringe area. There are some problems with water quality in the Long Tom Watershed mostly

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in the urban and agricultural areas.

The Long Tom River is essentially a valley stream in the process of developing its watershed. Most of the streams have steep headwaters with the exception of Elk Creek, which flows through Hale Valley (probably the former path of the Long Tom River into the Siuslaw River. Some tributaries of the Long Tom flowed into the Siuslaw River as well as the Middle Fork/Coast Fork and mainstem Willamette (Baldwin and Howell 1949). The best developed tributaries (Ferguson and Bear creeks) are those entering the lower reaches of the Long Tom; the headwaters are more diffuse, begin at a lower elevation, and probably have assumed their current development after the last ice age when considerable amounts of depositional materials from the nearby mountains and the Missoula flood events deposited material in the valley floor.

The southern-most tributary of the Long Tom is Coyote Creek. It originates off slopes of a different geologic origin than the majority of Long Tom tributaries. Its separation from the Siuslaw River, near Lorane, has an effective elevation of about 10 feet. Most of the headwaters for the Long Tom and tributaries flows off the eastern slopes of the Coast Range. The Coast Range, sedimentary sand and silt stone, is actively uplifting along the north-south line. As the Coast Range continues to uplift, the tributaries would be expected to respond by stream channel extension and down-cutting into the uplifting slopes.

Stream channel patterns are typified by limited headwater development, especially in Coyote Creek. The majority of the basin is low gradient valley floor, either part of the Willamette flood plain or unconfined valley floors in the Coast Range. Because stream gradients are low most of the basin is depositional, with only limited erosional and transport reaches.

Since the dominant underlying geologic materials are silt and sandstone, the majority of suitable materials entering the stream channel are small particle sizes. Lacking a source of materials, the stream channel has very limited larger rock such as boulders. The stream channel naturally contains mainly smaller particles. Extensive reaches, where the streams flow across the valley floor, are dominated by silt banks and channel bottom.

From information available, much of the basin was historically dominated by wetlands. Stream channels in valley bottoms were probably less well defined than at present, with channel changes and meandering during flood events. The low gradients contributed to retention of water and development of the wetlands.

FISHERIES & HABITAT

Native fish species include both salmonids and non-salmonids, and there are a variety of introduced species. The most widely distributed salmonid is the cutthroat trout, generally found where suitable habitat is present. Cutthroat trout and sculpin spawn and rear in upper reaches of the Long Tom River and tributaries. Rainbow trout and coho salmon were stocked in some streams during past years. No coho salmon are now known to use streams in the watershed, and any rainbow or steelhead use is indefinite at this time. Dace, redside shiner, and western brook lamprey also have been found in the watershed. In and near Fern Ridge Reservoir, fish species include largemouth bass, bluegill, crappie, pumpkinseed sunfish, bullhead, and carp. Amazon Creek and ponds in the watershed provide habitat for warm water game fish and other species. Lower Long Tom River also contains the following fish:

> Mountain whitefish, channel catfish, warmouth, sucker, mosquitofish, peamouth, chiselmouth, northern pikeminnow, three-spined stickleback, and Pacific lamprey.

Some chinook have entered the lower Long Tom River in the fall when higher flows were released from Fern Ridge Reservoir, and juvenile chinook may rear in the lower part of the river during winter. There are historic records, indicating bull trout may have been found in the Long Tom Watershed. It is unlikely they would have reproduced there, although there may have been foraging adults that migrated to colder water to spawn. Oregon chub previously were in the watershed, but now there are no remaining known populations. Stream channel alterations and flood control measures have reduced chub habitat, and there has been predation by exotic fish and bullfrogs. Crayfish also are common in various streams within the watershed.

Vegetation on neighboring slopes is predominantly western hemlock-Douglas-fir, which developed into its current pattern about 5-7,000 years ago. The older oak-pine-grasslands-wetlands on the valley floor and foothills in the watershed were maintained by the native Americans whose use of fire to manage the vegetation is well documented.

Riparian vegetation was a mixture of conifers, hardwoods, and wetlands. Large wood was certainly part of the stream system. Given the low gradients, wood would be likely to persist and contribute to the structure of the stream channels and to the development and maintenance of the wetlands in the basin.

Development in the watershed has altered the stream channels, adjoining vegetation, and water quality. Clearing of the land, draining of wet areas, water withdrawals, agricultural activities, urban development, development of an extensive transportation network, and modification of the historic burning patterns all contributed to these changes.

Many of the tributaries were ditched to facilitate run-off of water during storm events, which also resulted in reducing the amount of wetlands. Flooding still occurs during peak storm events. The Long Tom River itself, below Fern Ridge Dam, was channelized and its banks were armored to control flows and facilitate run-off. Many stream channels were apparently simplified. Channels lacking structure developed secondary incision into the valley floor, and larger pool habitats were greatly decreased. The amount of beaver activity, which would have contributed substantially to fish habitat, was also reduced by removal of the beaver from most of the basin. However, beaver dams and ponds have recently been observed in several streams in the watershed.

Riparian areas were simplified and reduced to open uplands for agricultural purposes. Agricultural lands are located throughout much of the watershed. Within the agricultural areas, hardwoods and brush are often in a narrow band along the streams. The potential for additional woody material to enter the channel naturally is limited.

Streams have been adversely affected by past logging practices, such as removal of riparian

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vegetation, slash burning near streams, and yarding through draws during winter rains Logging has continued in parts of Long Tom Watershed on public and private lands

BLM manages a limited amount of fish habitat in the upper watershed, where riparian vegetation contains many hardwoods, brush, and second growth conifers on and near BLM ownership Large conifers are present on part of BLM land along the upper Long Tom River Vegetative buffers have been left primarily along streams with fish As a result of the RMP more protection is now included farther upstream in the design of new timber sales Logs and large wood material have the potential to provide stream structure in and below locations where large trees are retained along the streams

Many roads have been constructed near and across streams at various locations Culverts at some of the roads obstruct fish passage for upstream migration A list of 16 culverts where passage may be improved is included under management opportunities in this analysis
The upper drainage streams have moderate to steep gradients with gravel, rubble, and sand in the channels Some mass wasting has been found in the watershed, and stream bank erosion occurs at various locations Downstream from headwater streams, there are larger amounts of silt where riffles and stream gradients are relatively low Temperatures that exceed levels for salmonids are common, especially in lower reaches of the Long Tom River and a few tributaries

Fern Ridge Reservoir provides water for stream flows, in addition to irrigation, recreation, wildlife, and retention for flood control No fish passage facilities are available at the dam A fish ladder is located farther downstream at a dam in Monroe, although the dam limits upstream passage of fish (including for any potential chinook migration) Irrigation dams are at various locations in the watershed

Additional information on fisheries and habitat in the Long Tom Watershed has been recorded by the Oregon Department of Fish and Wildlife The Long Tom Watershed Council has also prepared information on fish distribution and habitat conditions in the watershed (Thieman 2000) Fisheries and habitat aspects of this analysis include information from references prepared by ODFW and this Watershed Council Old records from the Fish Commission of Oregon contain more information on past conditions for the Long Tom River, which was surveyed during 1959 Records also are available on Long Tom River ~~Watershed~~ from 1938 surveys by the Bureau of Fisheries

RECREATION

Recreational activities on BLM lands consist of dispersed use The most common activities are OHV use, hunting, and driving for pleasure BLM has not developed facilities for any recreational activities on the valley fringe Most recreational visitors use the valley fringe area to make a quick escape during weekends from the urban communities The wetland area within the valley floor does provide some developed facilities, which include several Watchable Wildlife viewing areas and short hiking trails

Using the categories from the Recreation Opportunity Spectrum (ROS), "Urban" and "Rural" are applicable for the wetland parcels while "Roaded Modified" and "Roaded Natural" are relevant for the valley fringe.

The Urban/Rural categories are characterized by urbanized environment or substantially modified natural environment. Sights and sounds of humans are predominant and interaction between users is often moderate to high. Group activities are prevalent. Outdoor survival skills are unimportant and usually not practiced. The Roaded Modified/Natural categories are characterized by predominantly natural appearing environment. Sights and sounds of humans are moderate and interaction between users is moderate to low. Group and isolated activities can occur. Outdoor skills could be more important and practiced.

VISUAL RESOURCE MANAGEMENT

Visual resources vary within the watershed. Much of the watershed is within rural settings such as Vaughn, Noti, Crow, Alvadore, and Cheshire. The valley fringe is in a forested setting, while the center of the watershed is in an urban and agricultural setting. The majority of the watershed acres on BLM lands (valley fringe) are in VRM Management Class VI. There are 670 acres in VRM III and 0 acres in VRM II.

WILDLIFE

The Long Tom River Watershed encompasses about 262,749 acres in a wide diversity of habitats. BLM lands make up about 8.4 percent of the watershed and are concentrated in the Coast Range foothills or "Valley Fringe". The Valley Fringe makes up about 22.6 percent of the watershed (97,415 acres). Because of the wide disparity in habitat types and issues between the Valley Fringe, where most of the BLM lands occur, and the rest of the watershed, this discussion will be confined primarily to the Valley Fringe habitats and associated wildlife species.

Douglas-fir forests comprise the majority of habitat within the Valley Fringe and, over the last century, forest structure has changed from predominately large patches of old forest habitat to predominately smaller dissected patches of early/mature forest structure. Today, older forest characteristics are less available, continuous forest canopy is more fragmented, and young forest patches are more widespread. Wildlife species composition reflects the structure of the habitat. Therefore, these changes in vegetation structure have resulted in a reduction in the number and distribution of species that tend to exploit late-successional forest structure when compared to the past. Conversely, species that can exploit more open young forest habitats are more abundant and widespread. Riparian species composition is altered as well.

Beaver were an important component of the riparian community that created a desirable riparian environment for an array of species. Reduction in numbers and distribution of beaver, along with other factors, have changed riparian function and vegetation structure to a less desirable condition for many.

The driving factor that shaped the structure and composition of this watershed's modern habitat

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pattern was the human land use practices of the last 150 years. Much of the human activity in the Valley Fringe was associated with timber harvest. National concern regarding the structure and composition of these habitats during the past decade has resulted in changes in State and Federal regulations and land use planning and, while logging continues today, there has been a reduction in timber harvest on public lands in recent years. Current land use allocations on BLM lands designated 7,838 acres (38.5 % of federal ownership) as Late-Successional Reserves (LSR) that are managed to promote late seral conditions beneficial to species such as the northern spotted owl and the marbled murrelet. The remainder of BLM lands are designated as either General Forest Management Areas (GFMA) (10,542 acres and 52% of federal ownership), which are managed primarily for timber production and the promotion of early to mid seral forest conditions beneficial to those species requiring younger stands for some or all of their life needs, or Connectivity Blocks (1,962 acres, 9.7% of federal ownership) that are designed to allow adequate habitat for dispersal of species such as the spotted owl. Only certain forest practices are allowed to take place in Connectivity blocks, none of which can compromise the linkage quality of the area. Five core areas for spotted owls, totaling 503 acres, are also located within this watershed, as well as 6 sites allocated for bald eagle recovery totaling 192 acres.

There are several species of special interest residing in the Valley Fringe. These include game species such as black-tailed deer, black bear, and mountain lion; species protected by the Endangered Species Act; species specially managed through BLM policy; and species that are of special interest to the State of Oregon.

Managed under the West Eugene Wetlands Plan completed by the City of Eugene in 1992, the Bureau of Land Management has acquired approximately 1250 acres to protect and restore wetland ecosystems in the Southern Willamette Valley. The project includes portions of the Long Tom River drainage including Amazon Creek, Coyote Creek, and Willow Creek basins. The BLM, City of Eugene, and the Nature Conservancy formed a partnership in February 1994 to cooperatively manage the wetlands. Since then, the U.S. Army Corps of Engineers and the Oregon Youth Conservation Corps have also joined in as formal partners.

The current wetland prairie community contains a number of rare plants, including endangered species. The area supports a wide variety of wildlife species including over 160 birds and the endangered Fender's blue butterfly. Oak savannah habitat adjacent to the wetlands also represents a dwindling habitat type valuable for plant and animal species diversity and watershed protection in the project area.

BOTANY

Special Habitats and TPCC Withdrawals

No specific field inventories for special habitats have been conducted in the Long Tom Watershed at this time. The closest estimate of acres of special habitats present within the "forest fringe" of

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the Long Tom Watershed was derived from a GIS layer entitled the Timber Production Capability Classification (TPCC). The TPCC layer includes steep, fragile and/or non-timbered lands that are withdrawn from the land base that BLM manages for timber production. These TPCC withdrawal patches range from 1 to 123 acres in size and total 798 acres for the watershed. TPCC classifications were grouped to arrive at two classifications for the forest fringe area of the Long Tom Watershed; 64 sites and 558 acres of rock/steep, and 49 sites and 240 acres of water. The steep classification would not be indicative of special habitats but represents land withdrawn from timber production because timber removal would lead to a moderate to high probability of landslides in those areas. The "rock" type could potentially indicate the presence of cliff, talus slopes, or rock outcrop types of special habitats. The "water" type might indicate the presence of wet meadows, ponds, marshes, swamps, or other types of wetland areas.

All lands within the West Eugene Wetland Project area would be considered special habitat within the context of the Long Tom Watershed. This area includes some of the last remaining intact remnant Willamette Valley plant communities. Prior to European settlement, the Willamette Valley was once an extensive prairie/wetland ecosystem with a mosaic of riparian gallery forests and oak and pine savannas and woodlands. Less than 1 percent of Willamette Valley prairies exist today due to urban, rural, and agricultural development and succession to forested habitats. Today, Willamette Valley native ecosystems are some of the most endangered ecosystems in Oregon.

Special Status Species - Plants

Surveys for Special Status Species (SSS) vascular plants have primarily been botanical clearances in support of other resource programs such as timber management, wildlife enhancement, recreation projects, special use permits, etc. Wetland mitigation and management work have also prompted botanical survey work on lands in the West Eugene Wetland Project Area. At the end of 1998, a total of approximately 3935 acres within the Long Tom Watershed had received in-season field clearances for SSS plants. Thus, about 1.5 percent of all lands and about 18 percent of BLM lands in the watershed have been surveyed for SSS plants.

A total of 23 Special Status and species of interest had been identified in the Long Tom Watershed by the end of 1998. Seventeen species, including one Federally listed Endangered species, two species currently Proposed for federal listing, and three Bureau Sensitive plant species occur exclusively within the approximately 1300 acres of the West Eugene Wetlands Project area. These lands represent only 0.5 percent of the total Long Tom Watershed area and approximately 6 percent of BLM holdings in this watershed area, but are critical in supporting rare plant communities and populations. Approximately 536 acres, 41 percent, of the current BLM West Eugene Wetlands Project area lands have been surveyed for SSS plants. Land purchases are continuing in the Wetlands Project area and are expected to reach a total of about 2000 acres. Although the West Eugene Wetland Project area lands provide critical habitat for numerous Special Status plant species, this document does not detail specifics of this portion of the watershed. Please refer to Chapter 3 and documents referenced in that Chapter and the West Eugene Wetlands Plan (1992) and associated documents for additional information concerning the West Eugene Project Area and unique plants and communities of Willamette Valley ecosystems.

A lesser number of species and sites of SSS plants occur in the forested habitat ("fringe" habitat) along the eastern edge of the Coast Range and the most westerly edge of the Long Tom Watershed. This forest fringe area is the BLM's area of primary focus for this Watershed Analysis. Those species of forested habitats found on BLM lands in the watershed include the "Bureau Sensitive" species: wayside aster (*Aster vialis*) and tall bugbane (*Cimicifuga elata*); Bureau Tracking species: branching montia (*Montia diffusa)* and broomrape (*Orobanche pinorum*); the Survey and Manage species: candystick (*Allotropa virgata*); and a species of interest in Lane County: rosin weed (*Calycadenia truncata*).

Protection Buffer and Survey and Manage Plants

Protection Buffer (PB) and Survey and Manage (S&M) plant species were identified during the formation of the Northwest Forest Plan to be considered under ecosystem management. Surveys for PB and Component 2 S&M species as listed in the ROD began during spring 1998 on the Eugene District. To date, only four proposed project areas involving approximately 241 acres (0.09% of the watershed and 1.1% of BLM ownership) have been searched for PB and S&M species in the Long Tom Watershed. Two Protection Buffer species have been located in the Long Tom Watershed including a moss, *Ulota megalospora*, and a fungi, *Sarcosoma mexicana* (which is also a Component 3 Survey and Manage fungi). Additionally, one S&M Component 1 and 3 fungi species, *Helvella compressa*, and one S&M Component 1 and 3 lichen species, *Loxosporopsis corallifera*, have been found at one location each in the Long Tom Watershed.

The lack of information about Survey and Manage species and their distribution, abundance, and habitat needs makes it difficult to predict the potential occurrence of these species in the watershed. Current understanding of specific habitat requirements for these species is likely to improve as more information becomes available. It is probable that additional PB and S&M species and sites occur in the watershed.

SPECIAL AREAS

Special Areas are defined as Areas of Critical Environmental Concern (ACEC), Research Natural Areas (RNA), Outstanding Natural Areas (ONA), or Environmental Education Areas (EEA). Fox Hollow ACEC/RNA, Long Tom ACEC, and the Lorane Ponderosa Pine Potential ACEC are located in the Long Tom Watershed. Fox Hollow ACEC/RNA was established in 1984 to provide an example of dry-site, mature Douglas-fir and ponderosa pine (*Pseudotsuga menziesii/Pinus ponderosa*) forest in the Willamette Valley foot hills (RMP 1995). The Long Tom ACEC was designated in 1984 to provide an example of Willamette Valley native plant communities. The Lorane Ponderosa Pine Potential ACEC may be designated during the next planning process to represent another remnant dry-site mature Douglas-fir forest (with a component of ponderosa pine) in the Willamette Valley foothills.

Additional potential Special Areas will be evaluated and proposed in concert with inventories of special habitats and as plant association and other information is collected on the Eugene District. All Proposed Special Area sites will be reviewed during the next planning process for Special Area designation.

NONNATIVE PLANTS AND NOXIOUS WEEDS

The species composition of the Long Tom Watershed area has been modified by accidental and deliberate introduction of nonnative (species imported into the flora after European settlement) plant species. A number of nonnative species that are now naturalized (established and reproducing) in this watershed were intentionally introduced as orchard, food-crop, hedgerow, and ornamental plants (e.g., pear -*Pyrus communis*; sweet cherry - *Prunus avium*; domestic apple - *Pyrus malus*; English hawthorne - *Crataegus monogyna*; sweetbriar - *Rosa eglanteria*). Other nonnative species arrived in association with livestock, various types of cargo, ballast water, and in imported agricultural seed mixes. Roads are a primary medium for the establishment and expansion of most nonnative and noxious weed species on BLM forest land. A recent noxious weed survey on BLM lands identified widespread, low to moderate concentrations of Scot's broom (*Cytisus scoparius*) along roadways within the Long Tom Watershed area. Scattered spot locations of meadow and spotted knapweed (*Centaurea pratensis* and *Centaurea maculosa*) are known to occur on private lands along State and Lane County roads on the Valley floor and Coast and Cascade Range foothills. Purple loosestrife is also known to occur in spot locations on private lands along tributaries of the Long Tom River.

VEGETATION

The forested plant communities in the Long Tom Valley Fringe are within the western hemlock (*Tsuga heterophylla*) zone as described by Franklin and Dyrness (1973). The major coniferous tree species include Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*T. heterophylla*), western red cedar (*Thuja plicata)*, incense cedar *(Calocedrus decurrens)*, and grand fir *(Abies grandis)*. Hardwood species include red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), golden chinquapin (*Castanopsis chrysophylla*), Pacific madrone (*Arbutus menziesii)*, and Pacific dogwood (*Cornus nutallii*). The shrub and ground cover species associated with these forested plant communities are varied, and plant associations have not yet been developed for the watershed. Common understory species include vine maple (*Acer circinatum*), hazel (*Corylus cornuta*), oceanspray (*Holodiscus discolor*), salal (*Gaultheria shallon*), Cascade Oregon grape (*Berberis nervosa*), salmonberry *(Rubus spectabilis)*, poison-oak *(Rhus diversiloba)*, and sword fern (*Polystichum munitum*).

For BLM administered lands, upland plant communities within this zone have been classified into major plant groupings (RMP EIS, pp. 3-41). The forest vegetation of the Long Tom Valley Fringe lie within 2 of these groupings. The Douglas-fir/red alder/vine maple grouping is found on the drier sites on eastern slopes of the Coast Range and occur on the majority of the Long Tom Valley Fringe; and the Douglas-fir/ocean spray/herbs and grasses grouping is found adjacent to the valley floor (primarily east of the Lorane highway) on warm, dry sites at low elevations (less than 1,500 feet).

The younger forest vegetation classes are predominate across the landscape of the Long Tom Valley Fringe. The clear cut and sapling pole forest vegetation classes combined (0-29 years in age) account for approximately 20 percent of the forest vegetation within the valley fringe and the pole-young forest vegetation class (30-79 years in age) accounts for approximately 35 percent of the forest vegetation within the valley fringe. Mature forests (80-199 years of age) make up approximately 2 percent and the old forests (200 years plus) make up approximately 4 percent of the valley fringe. The uneven aged forests (Mature over young and old over young vegetation classes) make up approximately 6-7 percent of the valley fringe. Hardwoods and mixed-conifer hardwoods combined make up approximately 17 percent of the valley fringe, and the nonforest areas account for approximately 15 percent of the valley fringe.

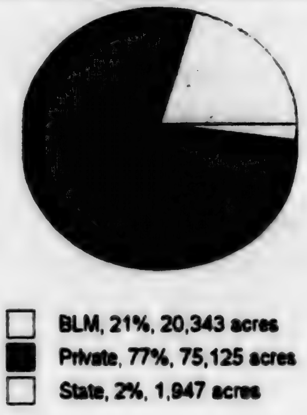
LAND OWNERSHIP

The Long Tom Valley Fringe is highly dissected relative to ownership. The BLM manages approximately 20,343 acres or approximately 21 percent of the valley fringe with the remainder in State and private ownership. The State of Oregon administers approximately 1,947 acres or 2 percent of the valley fringe. The remaining 75,125 acres (77%) of the valley fringe is within private land holdings.

Roseburg Resources (10.3%), Willamette Industries (6.9%), Swanson-Superior (5.1%), Giustina (3.4%), and Transition (2.4%) are the larger private landowners.

Other primary landowners include Rosboro, Starker, Templeton, Weyerhaeuser, Seneca, Spencer, Rothauge, Koozer, Mobile Oil Corporation, and Zip-O-Log whose combined ownership is approximately 8 percent of the valley fringe. Many small private landowners make up the remaining 41 percent of the ownership (see Figure 1-1 and the Maps "Major Land Owners of Coast Region/Long Tom in 1997" and "Major Land Owners of South Region/Long Tom in 1997").

Figure 1-1 Long Tom Valley Fringe Ownership



Within the valley fringe analysis area of the Long Tom Watershed, BLM manages 25.7 percent of the vegetation along the 1st, 2nd, and 3rd order streams and only 7.6 percent of the vegetation along 4th order and larger streams within the watershed. Due to this ownership pattern along streams BLM can best manage the upper smaller reaches of streams within the watershed.

Land ownership and pattern of ownership along the streams within the Long Tom Watershed is a constraint affecting BLM's ability to manage aquatic and riparian resources especially along 4th order and larger streams within the watershed where riparian restoration projects to restore instream structure and habitat could be feasible. Due to the limited BLM land along these larger order watershed streams it may be necessary to enter into cooperative agreements both with the public and with private and/or State agencies. Land exchanges are another avenue that could be pursued to strengthen BLM's ability to manage fisheries within the watershed.

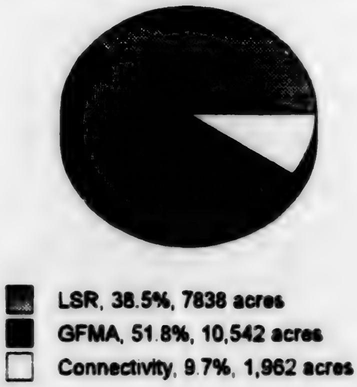
MANAGEMENT

Land Use Allocations - The **Matrix** land use allocation makes up approximately 61.5 percent of the BLM ownership within the analysis area and is comprised of both **General Forest Management Area** (GFMA) lands and **Connectivity** lands. The GFMA makes up approximately 51.8 percent of the BLM ownership within the analysis area and the Connectivity makes up approximately 9.7 percent of the BLM ownership within the analysis area. The bulk of the Connectivity is located in the "South Region of the Long Tom".

The primary management emphasis for the **Late-Successional Reserves** is the development of habitat for late-successional associated species. Late-Successional Reserves (LSR) have been designated on 38.5 percent of the BLM administered lands within the valley fringe. Late-Successional Reserves account for approximately 8 percent of all lands within the valley fringe and are found primarily in the westerly portion of the "Coast Region of the Long Tom". The Late-Successional Reserves are interspersed or checkerboarded with private ownership.

Figure 1-2 Long Tom Valley Fringe

Land Use Allocation



The **Riparian Reserve** overlaps both the Matrix and LSR land use allocations. Approximately 46 percent of the BLM ownership within the analysis area is within Riparian Reserve and is being managed for Aquatic Conservation Strategy Objectives. A total of approximately 13,621 acres or approximately 67 percent of the BLM ownership within the Long Tom valley fringe is currently being managed toward late-successional forest habitat either as designated Riparian Reserves or Late-Successional Reserves.

Other reserves and special management areas include Designated District Reserves totaling 12 acres; 65 sensitive plant sites totaling approximately 238 acres; 6 bald eagle recovery sites totaling approximately 192 acres; 5 known spotted owl habitat areas totaling 503 acres; 3 Areas of Critical Environmental Concern (ACECs) totaling 250 acres (includes one ACEC outside the valley fringe analysis area); parts of two Special Recreation Management Areas totaling approximately 279 acres; one progeny test site (Ferguson) of approximately 79 acres; and 13 Rural Interface sites totaling 400 acres. The map titled "Long Tom Landscape Analysis Unit" shows these LUAs, reserves, and special management areas.

The 15% Retention Requirement

The 15 percent retention Standard and Guidelines (S&G) is designed to retain and protect ecologically significant forest stands, patches, and fragments that provide biological and structural diversity to function as refugia for old growth associated species in watersheds where little late-successional forests remains. Benefitting from this mitigation are the full array of species identified in Appendix J-2 of the Final Supplemental Environmental Impact Statement (FSEIS 1994).

The current 1998 Forest Operations Inventory (FOI) data indicates that approximately 16 percent of the Federal (BLM) forested acres within the Long Tom Watershed are currently in a late-successional (≥80 years of age) condition of which approximately 14 percent are located in reserves. The remaining 2 percent of these late-successional forested acres are located within the upland Matrix. The 1998 FOI data indicates the BLM is approximately 192 acres over the required acreage of late-successional habitat (≥80 years of age) to meet the 15 percent late-successional retention requirement within the watershed on federal lands. (This includes all LUAs within federal ownership within the watershed.) The maps titled "Areas Identified to provide 15% Late-Successional Habitat in Coast Region/Long Tom" and "Areas Identified to provide 15% Late-Successional Habitat in South Region/Long Tom" show the location of these late-successional stands. Management of the 15 percent late-successional is addressed in Chapter 4.

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CHAPTER 2
Issues and Key Questions

The Long Tom Watershed Analysis Team developed the set of issues and pertinent questions used in this analysis. The purpose of the issues and key questions was to guide the team's focus during the analysis and narrow the scope of the analysis to those issues of importance on this landscape. As expected, several of the issues identified are common to more than one program or resource and considerable interrelationship is noted.

The Eugene District Resource Management Plan and the Northwest Forest Plan designate land use allocations on Bureau of Land Management lands in the Coast Range and South Valley Resource Areas and provide management direction for federal lands in the watershed. Issues identified for the watershed analysis focus on those concerns relevant to implementation of these plans.

A Watershed Analysis Scoping Notice was published in the April 1999 issue of BLM's "Eye to the Future" planning and project focus newsletter. A project startup meeting was held to present the project to LCOG, USFWS, and Long Tom Watershed Council to provide information on the process and coordinate information exchange possibilities. No new issues were brought forward as a result of this meeting nor the newsletters. The USFWS participated in the watershed analysis as their time and work load allowed.

GEOLOGY & SOILS

ISSUE - A proportion of the Long Tom Watershed's Foothill Fringe consists of high risk sites for landslides.

ISSUE - A proportion of the road network within the Long Tom Watershed's foothill fringe is capable of delivering flow and sediment to the stream channel system.

HYDROLOGY

What are the climate and stream flow characteristics of the watershed including extremes in flows and precipitation for the watershed?

How will BLM practices affect both peak flows and low flows?

What streams are presently on the State 303d list, and how will BLM practices affect this?

What is the potential for LWD inputs to channels? Included are the stream side potential and the potential for landslide delivery.

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How will roads affect peak flows and sediment delivery to streams?

FISHERIES

ISSUE - Resident salmonid populations may have declined to a fraction of historical levels.

What is the distribution of salmonids in the watershed?
What is the current population of salmonids?
What are the factors limiting populations of salmonids in the watershed?
What is the role of introduced species in the composition of the aquatic community?

ISSUE - Aquatic habitat has declined and is generally in poor or fair condition.

What is the current pattern, status, and trend for individual streams and reaches in the basin?
What factors are influencing habitat in the watershed?
What is the status of the habitat and associated communities for non-salmonid fish?
What are the opportunities for improving habitat?

ISSUE - An extensive network of roads extends through much of the watershed.

What effects do the roads and culverts have on movement of resident fish?
How do the roads and culverts influence the sediment and hydrology processes in the watershed?

RECREATION

What are the recreational demands for this watershed, and can BLM provide facilities to accommodate them?

a) for the "fringe"
b) for the wetlands

Are recreational activities creating any conflicts and, if so, what are they?

a) for the "fringe"
b) for the wetlands

LAW ENFORCEMENT

What types of illegal activity are occurring in the watershed, and what management practices can be implemented to prevent or reduce them?

a) for the "fringe"
b) for the wetlands

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Wildlife issues for this watershed fall into two categories: "Fringe" Issues and Key Questions that pertain to the fringe lands including the bulk of the BLM ownership, and Issues and Key Questions that pertain to the watershed as a whole (including the valley floor).

"FRINGE" ISSUES AND KEY QUESTIONS

- What role does the watershed play in providing conservation or recovery of wildlife, especially as it relates to the BLM Eugene District's Resource Management Plan (RMP) and the Northwest Forest Plan (NFP) Strategy

- Late-Successional Habitat and Species - What is the amount and distribution of late seral stands within the watershed?

- Is this habitat able to fulfill the life history requirements of late seral species including but not limited to the northern spotted owl?

- Which stands appear structurally diverse?

- Are there stands lacking some late seral components (i.e., snags/down logs)?

- What is the expected spatial and temporal arrangement of this habitat, and how will this arrangement affect dependent species?

- How does wildlife composition and distribution differ within the fringe land from historic composition and distribution.

WATERSHED (including valley floor)

- Sensitive Species - What sensitive or special status species are known or expected to occur within the watershed? How much habitat for these species occurs within the watershed?

- Large mammals - What is the distribution and population structure of large mammals such as deer, elk, black bear, and mountain lion within the watershed? What is the habitat availability for these species?

- Unique Habitats - Are there any specialized or limited habitats within the watershed? What is the amount, distribution, and patch size of these habitats?

- Introduced Wildlife Species - What introduced wildlife species occur in this watershed? What implications does the presence of these species have on other wildlife?

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BOTANY

ISSUE - Special Status Plants

What Special Status (T&E, Bureau Sensitive, Bureau Assessment, Bureau Tracking, Survey and Manage, etc.) species are known to occur within the watershed?

What habitat types are required by these species, and what is their abundance and distribution within the watershed?

What are the factors limiting populations of Special Status, T&E, and Survey and Manage species in the watershed?

What are the threats to populations of Special Status, T&E, and Survey and Manage species in the watershed?

What are the historical disturbances that have occurred in the watershed, and how do they relate to the location/ecology of Special Status, T&E, and Survey and Manage species in the watershed?

How adequate is late-successional habitat with regards to viable populations of late-successional species such as the Survey and Manage species identified in the Northwest Forest Plan?

What is the expected arrangement and quantity of late-successional habitat in the future, and what will be the effect on those species thought to be dependent on this habitat?

What are the constraints, project opportunities, inventory needs, and monitoring opportunities given the questions above?

ISSUE - Special Areas

Do any special areas, including Research Natural Areas, Areas of Critical Environmental Concern, Environmental Education Areas, or Adaptive Management areas occur within the watershed?

Where do those special areas occur, and what features were they established for?

Are there other special areas that could be established in the watershed area?

ISSUE - Unique Habitats

What unique/special habitats are known to occur within the watershed?

What is the abundance and distribution of these habitats in the watershed, and what are the processes that have led to their development and help to maintain them?

ISSUE - Noxious Weeds and Nonnative Plant Species

What noxious and nonnative plants occur in this watershed and what is their distribution?

What implications do the presence of these species have on the public and in maintaining native plant communities across the landscape?

ISSUE - Special Forest Products

Are there any potential conflicts between Botanical Resources and the harvesting of Special Forest Products (SFP)?

VEGETATION

ISSUE - Past and Current Vegetation Patterns Within the Watershed and Disturbances that Contributed to Vegetation Conditions Within the Watershed

What were the past vegetation conditions and patterns within the watershed?

- Historic Vegetation
- Disturbance - (natural fires, wind blowdown, floods, landslides) and human (settlement, logging, roads, fire suppression, etc.)

What types of vegetation currently exist within the watershed, and how has the vegetation changed from past conditions? What is the current vegetation pattern and distribution?

- current vegetation
- ownership
- fragmentation
- Disturbance - (natural fires, wind blowdown, floods, landslides) and human (settlement, logging, roads, fire suppression, etc.)

What are the constraints, project opportunities, inventory needs, and monitoring opportunities given the questions above?

ISSUE - Current Vegetation Characteristics of the Matrix (GFMA and Connectivity) Within the Watershed and Management of the Matrix for Commodities given other resource objectives.

What are BLM's vegetation management opportunities within the Matrix to achieve commodity objectives? What other special resource management areas or special resource designations (i.e., Bald Eagle Habitat Areas, Rural Interface, etc.) must be considered in the management of the Matrix?

ISSUE - The 15 Percent Retention Requirement - Retention of Late-Successional Forest Within the Watershed.

What is the current level of late-successional forest habitat (i.e. mature and old growth forest ≥ 80 years old) within the watershed relative to the 15 percent late-successional habitat retention requirement?

- Where are these late-successional forests located, and what management constraints are appropriate?
- BLM Instruction Memorandum No. OR-98-100 provides implementation guidance on the 15 percent Standards and Guidelines.

ISSUE - Current Vegetation Characteristics Adjacent to the Streams Within the Watershed and the Potential Sources for Large In-stream Structure Based on Current Streamside Vegetation Conditions.

What are the current vegetation characteristics adjacent to the streams within the watershed? Where and at what levels do potential sources for large instream structure exist within the watershed based on existing streamside vegetation conditions?

ISSUE - Current Vegetation Characteristics of the Riparian Reserve Within the Watershed and Management of the Riparian Reserve for Aquatic Objectives and Connectivity.

What are the current vegetation characteristics of the Riparian Reserve within the watershed? How can BLM best manage the current vegetation within the Riparian Reserve to meet fisheries and aquatic objectives on a watershed level?

ISSUE - Current Vegetation Characteristics of the Late-Successional Reserve Within the Watershed and the LSR Assessment Objectives of Expanding Existing Large Blocks of Late-Successional Habitat Within the LSR (To Increase Interior Habitat and Connect These Large Blocks to Best Provide for Connectivity of Late-Successional Species).

What are the current vegetation characteristics of the LSR? What are BLM's best vegetation management opportunities within the LSR of the watershed to meet wildlife resource objectives? What other special resource management areas or special resource designations (i.e., Bald Eagle Habitat Areas, Rural Interface, etc.) exist within the LSR?

ISSUE - Land Ownership Patterns - Checkerboard Ownership; Pattern of Ownership Along Streams; and Land Exchanges.

- Identify the current land uses (i.e., Off Highway Vehicle use areas, land zoning, etc.) and their location/impacts in relation to critical resources or critical resource areas.

- Look at the broad ownership pattern in relation to critical resources to identify coarse scale patterns and their effect or impact on BLM ability to manage vegetation for resource objectives, i.e., private lands adjacent to riparian areas and streams.

- Attempt to identify opportunities, constraints, issues, etc. tied to present ownership patterns in relation to the management of vegetation for resource objectives. (Address Rural Interface and identify opportunities/constraints concerning management activities.)

- What are the priorities or opportunities for land exchanges to benefit the management of the LSR?

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CHAPTER 3
Past And Present Conditions

This chapter describes current and/or reference conditions that are relevant to the issues and key questions identified earlier and documents the current range, distribution, and condition of core topics and other relevant ecosystem elements. It also indicates where data gaps have been identified relative to resource management. For several of the resources addressed in this watershed analysis there are data gaps that could be filled by inventories. Design and implementation of inventories can improve baseline information available for future analysis and management in the Long Tom Watershed. This chapter's information is used in interpretation of watershed data and ecosystem processes and in the design of proposed management opportunities.

BACKGROUND - The prehistory of the Long Tom sub-basin has been studied more intensively than the prehistory of any other sub-basin in the in the Upper Willamette River Basin. Scientific excavation of archaeological sites in the Long Tom sub-basin began in 1933 when Luther Cressman and students from the University of Oregon excavated at the Virgin Ranch site and the Smithfield site near Franklin, Oregon although the results of the excavations were never reported. During 1950 a crew from the University of Oregon excavated at the Perkins Peninsula site (Collins 1951). Collins made reference to the Virgin Ranch, Smithfield and Perkins Peninsula sites, as well as other sites in the Willamette Valley, in his masters thesis that explored the position of the Kalapuya Tribe in the culture area concept.

Following a 15-year hiatus scientific archaeological excavations were again conducted in the Long Tom sub-basin when members of the University of Oregon Department of Anthropology field school excavated at the Lingo site during the summers of 1965 and 1966 (Cordell 1967, 1975). During 1967 and 1968 U of O Anthropology Department field school students excavated the Benjamin sites (Miller 1970, 1975). The U of O Anthropology Department field school excavated at the Flanagan site during the summers of 1975, 1976, and 1978 (Toepel and Minor 1980; Toepel 1985a). During the summers of 1982 and 1983 field school personnel from the University of Oregon conducted extensive test excavations at 4 sites (Kirk Park sites 1-4) adjacent to Fern Ridge Reservoir. During January and February, 1984 crews from the University of Oregon conducted limited test excavations and made extensive surface collections at the Hanavan Creek site and the Perkins Peninsula site, located in the reservoir pool. Volunteers from the U of O Anthropology Department tested 2 sites in the Spencer Creek drainage south of Fern Ridge Reservoir during the fall of 1983 (Cheatham 1984, 1988).

Analysis of the cultural material from the Long Tom sub-basin, particularly the Lingo and Flanagan sites, produced information that contributed measurably in establishing a regional cultural chronology for the middle and upper Willamette Valley (Toepel 1985a). Information from the Kirk Park sites, the Hanavan Creek site, and the 1984 excavation and surface collection at the Perkins Peninsula site indicates a subsistence-settlement pattern for the Late

Archaic period in that portion of the Long Tom sub-basin encompassing Fern Ridge Reservoir and the immediately adjacent area (Cheatham 1988).

Archaeological inventory designed to locate previously unrecorded sites began in the Long Tom sub-basin during the summer of 1970 in conjunction with the Willamette Valley Prehistory Project. Although the scope of the Willamette Valley Prehistory Project extended well beyond the Long Tom sub-basin, 12 prehistoric archaeological sites were located by survey teams (Southard 1970; Woodward 1970) north of Fern Ridge Reservoir.

Survey efforts within the Long Tom sub-basin include the Flat Creek Survey conducted by the Oregon State University Department of Anthropology (Piontkowski, Brauner and Davis 1974), Lane County Waste Disposal Area Surveys (Folansbee 1978; Folansbee and May 1979), Fern Ridge Reservoir Survey (United States Army Corps of Engineers 1981), and the Long Tom Archaeological Survey (Toepel 1985b). With the exception of the latter inventory efforts archaeological site surveys in the Long Tom sub-basin have been limited to relatively small areas that have yielded a small number of archaeological sites. The Corps of Engineers sponsored Fern Ridge Reservoir Survey covered much of the reservoir bottom above the low pool stage and resulted in the discovery and recordation of 80 sites with prehistoric components. The Long Tom Sub-basin survey inventoried a total of 6,440 acres and resulted in the discovery and recordation of 60 sites with prehistoric components.

With the exception of the Long Tom Sub-basin Survey and cultural resource surveys conducted by personnel of the Bureau of Land Management, site surveys in this sub-basin have been limited to the flood plain at elevations at or below 400 feet above mean sea level. Most of this area was prairie or riparian forest and swamp in the early 1850s (Webster 1853a, b, c).

Eight surveyed tracts located in the western portion of the Long Tom Sub-basin Survey project area include terrain with elevations between 400 and 900 feet above mean sea level (Toepel 1985b). These tracts are situated in areas characterized by scattered oak, Douglas-fir and ponderosa pine; scattered Douglas-fir and oak; and scattered Douglas-fir tree cover during the early 1850s (Webster 1853a, b, c).

Beginning in 1975 Bureau of Land Management personnel conducted cultural resource surveys in advance of surface disturbing actions in the Long Tom sub-basin. To date, a total of 5610 acres of Bureau administered land have been surveyed in advance of potential surface disturbing actions. An additional 460 acres of Bureau administered land were surveyed by crews from the University of Oregon as part of a Class II cultural resource inventory effort (Connolly and Willingham 1980). These surveys were conducted with the forest cover intact. Bureau of Land Management personnel have conducted post-harvest cultural resource surveys on 445 acres of Bureau administered land. The latter acreage was surveyed following timber harvest and the reduction of logging slash. The majority of the Bureau administered property that was surveyed for cultural resources is located at elevations between 600 and 1200 feet above mean sea level. Most of the Bureau administered lands are located in areas characterized by either scattered

Douglas-fir timber or mature conifer timber dominated by Douglas-fir during the 6th and 7th decades of the 19th century.

A total of three isolated artifact locations have been discovered on Bureau-administered land in the Long Tom WAU.

PREHISTORIC PERIOD USE

The archaeological record in the Willamette Basin is divided into the following generally agreed upon sequence as proposed by Toepel (1985:146-162): Paleo-Indian Period (11,000 - 8,000 B.P.), Early Archaic (8,000 B.P. - 6,000 B.P.), Middle Archaic (6,000 B.P. - 2,000 B.P.), and Late Archaic (2,000 B.P. - 250 B.P.). A short Historic Period covering the time between the introduction of European trade goods around 1750 and the signing of the Dayton Treaty in 1855 and the subsequent removal of the remaining indigenous population to reservations completes the sequence of cultural periods.

Within the Long Tom sub-basin archaeological assemblages representing the early Middle Archaic Flanagan Phase, the late Middle Archaic Lingo Phase and the Late Archaic Hurd Phase have been recovered from radiocarbon dated excavated cultural deposits. Several sites have also yielded trade goods of European manufacture indicating occupation during the brief Historic Period Ethnographic Phase. Surface collections from a number of other sites have produced temporally sensitive artifact types (usually projectile points) which allowed the sites to be assigned to one or several of the above archaeological periods.

The majority of the sites in the Long Tom sub-basin assigned a temporal and cultural affiliation were placed in the Late Archaic Hurd Phase. A smaller number of sites were assigned to the late Middle Archaic Lingo Phase and fewer still were assigned to the early Middle Archaic Flanagan Phase. No recorded sites in the Long Tom sub-basin have components identified as belonging to the Early Archaic Period or the Paleo-Indian Period. The fact that cultural materials representative of the Paleo-Indian and the Early Archaic periods have not been discovered to date in the Long Tom sub-basin does not mean that these materials may not be present. Given that much of the sub-basin has experienced a depositional/erosional regime characteristic of a mature river valley, cultural deposits 8000 to 11,000 years old are likely to be deeply buried or to have been removed by erosion as the course of the Willamette River has moved back and forth across the valley floor.

Using information gained from the Kirk Park, Perkins Peninsula, and Hanavan Creek excavations as well as information gathered during the several archaeological surveys conducted in the Upper Willamette Valley during the 1980's, Cheatham (1988) developed a possible Late Archaic settlement pattern for the Upper Willamette Valley. Cheatham's settlement pattern recognizes three site types: winter villages, summer base camps, and task specific sites. The winter village sites had an areal extent greater then 28,000 m^2, were located on terrain lying above 100 year flood events with dry-land access to the uplands during flood events, and have artifact assemblages characterized by a large number of tool types including a high frequency of cobble tools. Summer base camps may also have been large, some as large as 28,000 m^2, and have artifact assemblages characterized by a large number of tool types, although with lower

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frequencies of cobble tools compared to assemblages from winter village sites. Summer base camps are located on the lower, seasonally flooded surfaces of the valley floor. Task specific sites are small, have limited artifact assemblages, and may be located on the flood plain, scattered across the higher elevation surfaces of the valley floor or situated on the lower slopes of the foothills surrounding the valley.

Winter villages were occupied 5 to 6 months a year with occasional forays made to nearby task specific sites. Although hunting undoubtedly supplied some fresh meat, subsistence during the winter months depended on stored foods. Sometime during the late spring, when flood waters had receded sufficiently, the occupants of the winter village moved out to summer base camps located on the flood plain near major camas fields. Summer base camps might have been used for the harvest and processing of camas or these activities might have been carried out at nearby task specific sites. The summer base camps also served as a base for hunting forays to nearby riparian gallery forests or adjacent open wooded slopes.

ETHNOGRAPHIC PERIOD

The Long Tom Watershed was the home of the Chelamela band of the Kalapuya until the signing of the Dayton Treaty in 1855 and the removal of the remaining Native American peoples in the Willamette Valley to the Grand Ronde reservation beginning in 1856 (Beckham 1976). By 1856 the Native American population of the Willamette Valley had been reduced by orders of magnitude. What had been an estimated population of 10,000 people in the middle of the eighteenth century was reduced to less than a thousand people by the time of the removal. To the west the territory of the Chelamela abutted that of the Siuslaw.

Little is known of the life way of the Kalapuya bands living in the southern two-thirds of the Willamette Valley. Ethnographic studies of the Kalapuya were not initiated until the twentieth century. These studies utilized informants who traced their ancestry to Kalapuya bands who had formerly inhabited the Lower and Middle Willamette Valley. Information gathered from these studies relating to settlement pattern agrees closely with the settlement pattern model developed by Cheatham (1988) for the Late Archaic occupants of the Upper Willamette Valley (Zenk 1976).

Although not a numerous people, the Kalapuya and their antecedents had at their disposal a powerful tool which could be used for land management purposes - fire. The Kalapuya used fire in order to encourage the growth of new grass as forage for game animals, to reduce competition for preferred food plants like camas, to assist in the harvest of certain foods such as tarweed seeds or caterpillars and yellow jacket larvae, to improve the quality of basket-making materials and to stimulate and renew berry patches (Boyd 1986). Anthropogenic fires maintained large acreage in prairie or prairie/savanna on the floor of the Willamette Valley and tributary valleys while in adjacent uplands frequent fires altered the form and composition of the forests cloaking the hillsides. Some idea of the extent to which anthropogenic burning altered the vegetation in the Long Tom WAU can be gained by comparing the map displaying the historic vegetation pattern (circa 1850) with the map displaying the vegetation pattern current during the mid-1930s in the section on vegetation in the Past and Current Conditions chapter of this document. Recent research by a U of O graduate student (Geography Dept.) suggests that fire may not have been as deliberately used by the Kalapuya as previous research has suggested.

EURO-AMERICAN EXPLORATION

Beginning in the third decade of the 19th century brigades of trappers from the Hudson's Bay Company began to traverse the length of the Willamette Valley on their journeys to Southwest Oregon and northern California. These annual trips by the fur brigades and the later supply trains which served the Hudson's Bay post at Ft. Umpqua followed a trail down the west side of the Willamette Valley and through the Long Tom drainage. During 1841 a contingent of the U.S. South Seas Surveying and Exploration Expedition passed through the Long Tom drainage on their journey to California. A party surveying the Southern Emigrant Route or the Applegate Trail in 1846 also traversed the Long Tom drainage (Toepel and Beckham 1982).

EURO-AMERICAN SETTLEMENT

The level prairies in the eastern portion of the Long Tom drainage were prime locations for early immigrants to the Upper Willamette Valley who sought prime agricultural land. The five earliest claims in the drainage were staked prior to 1850 and recognized under the authority of the Donation Land Claim Act following the formation of the Oregon Territory in 1850. Three of the claims were located on the west bank of the Long Tom in the vicinity of present day Richardson Butte (named for one of the pre-1850 settlers). Two claims were staked along Coyote Creek (then known as the East Fork of the Long Tom River) approximately one-and-one-half miles east of the present-day community of Crow. Most of the remaining bottom land and much of the bench land and low hills west of the valley bottom proper was settled by 1855 when the Donation Land Claim Act for the Oregon Territory was terminated. Not only was this land well suited to agricultural purposes due to the topography and soil quality, it was adjacent to a trail that connected to California and the burgeoning population of miners in that state. This trail, which soon became a wagon and stage road, came to be known as the Territorial Road and later the Territorial Highway. Traffic along the trail provided a ready market for crops and produce that were sold in small quantities to travelers on the trail and marketed in larger quantities to entrepreneurs who purchased for resale in California.

Following a pattern found in other watersheds in the Eugene District, land less suited for agriculture, whether due to topography or to the lack of ready transportation, was left for the later arrivals. These would-be settlers sought land under the Homestead Act of 1862 that granted up to 160 acres for a nominal filing fee for those who met the residence and improvement requirements. Land could also be purchased for prices ranging between $1.25 and $2.50 per acre under the Cash Entry provision. The fact that much of the unclaimed land following 1855 was not well suited to agricultural purposes is illustrated by the numerous homestead entries filed and canceled within a year or two. Although homestead entries continued to be filed on lands in the watershed until the 1930s there does not seem to have been the flush of "questionable" homestead entries filed between 1905 and 1915 that mark the records of some other watersheds in western Oregon. These "questionable" ones appear to have been made by "entrymen" acting as agents for large timber companies. The "entryman" was paid a sum of money to file a homestead entry on a piece of public domain land, make the minimum improvements necessary to "prove up" on the land, and occupy the land for the minimum time necessary to gain title. At that time the entryman would sign the title over to the officers of the timber company, which added land to the company's timber base. Perhaps the reason that this pattern of fraudulent homestead entry was

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not prevalent in the Long Tom Watershed was due to the relative scarcity of commercial timber in the watershed in the early 20th century. Fifty years earlier commercial stands of mature conifer forests were present only on the western fringe of the watershed.

The population of the Long Tom Watershed has remained largely rural in character. Although numerous rural post offices were established at places such as Long Tom (1853), Franklin (1855), Crow (1874), Elmira (1884), and Hadleyville (1890), only Elmira achieved a status greater than rural neighborhood or vicinage. Two other town sites, Veneta and Cheshire, were platted in 1912 and 1913 respectively. Of the two, only Veneta has risen to village status (McArthur 1984).

ECONOMIC DEVELOPMENT

Agriculture dominated the economy of the Long Tom Watershed in the 1900s but logging was a significant export in late 1800s, early 1900s. The earliest settlers, although practicing a subsistence agriculture, did find some outside markets and sources of cash money from travelers using the road to California. As local roads were built and improved farmers found outside markets for crops, cattle, and dairy products in Eugene but also found markets beyond the local when the Oregon and California Railroad reached Eugene in 1871, which opened up world markets via the port of Portland. Completion of a branch line railroad between Eugene and Coos Bay in 1916 provided additional access to extra-regional markets as well as rail transport to Eugene for shippers large and small in the central portion of the Long Tom drainage (Beckham 1981).

Logging and lumbering did not play as large a role in the local economy of the Long Tom drainage as it did in the Mohawk drainage, for example. One potential reason may have been the relatively small amount of merchantable timber present in the watershed around the turn of the century. The location of this timber along the western edge of the watershed, removed from ready access to transportation, may also have played a role. This is not to say that there was no logging and lumbering carried out in the Long Tom drainage. Louis M. Haselton operated a mill in Crow that produced 100,000 to 200,000 b.f. of lumber a year between 1902 and 1906. Several mills operated in Elmira between 1902 and 1917. The Elmira Lumber Co., for which data is available between 1913 and 1917, produced 6.5 MM b.f. a of lumber in 1917 (Beckham 1981: Table 21).

HISTORIC VEGETATION PATTERNS IN THE LONG TOM WAU

Background - Reconstruction of the historic vegetation pattern circa 1850 in the Long Tom Watershed is based on data from survey notes recorded by deputy surveyors employed by the Government Land Office during the course of establishing the rectangular survey on lands in Oregon (Christy et al. 1998). During the course of the survey of each section line the cadastral surveyor was required to record the species, diameter, and distance from the corner for each bearing tree at quarter-corners and section corners. In addition, surveyors were supposed to note significant changes in vegetation along the line being surveyed and to summarize vegetation conditions and other notable features for each mile surveyed. The quality and quantity of information recorded depended a great deal on the surveyor. Some went to considerable detail, both in the "calls" they made while surveying the line, and in their summary of conditions along the mile just surveyed. Others, unfortunately recorded only the minimal information necessary to conduct a legal survey; data relating to bearing trees, minimal line calls relating primarily to topography or hydrologic features, and a spare, unchanging, and uninspired summary description. The bulk of the survey in the Long Tom Watershed was conducted by 4 men: Kimball Webster, Daniel Herron, Butler Ives, and Harvey Gordon. Each of these deputy surveyors produced field notes of average or better than average quality. The surveys were conducted between 1853 and 1859.

Information regarding the vegetation pattern in the Long Tom Watershed during the 1930s is derived from information compiled by the USDA Forest Service and published in map form by the Pacific Northwest Experimental Station, Portland in 1936. Information for this map was compiled through field observation, albeit some of which was at a reconnaissance level rather than a section by section survey. Some incidental information has been taken from a map published by the State Board of Forestry in 1914. Information for this map appears to have been obtained in part by reconnaissance survey and in part by consulting county tax records.

EARLY HISTORIC PERIOD

The Early Historic Period Vegetation map presents the vegetation pattern of the Long Tom Watershed from the notes recorded by General Land Office deputy surveyors working between 1853 and 1859 (Christy et al. 1998). Utilizing notes and plat maps it was possible to define 10 mapping categories related to vegetation type in the watershed. An additional category of agricultural land was identified, but the acreage was so small and the parcels so tiny that it was not possible to map them at the scale of this map. Acreage and percent of the total watershed acreage for each vegetation type is presented in Table 3-1.

Prairie included the nonforested portions of the watershed. Most of the floor of the Willamette Valley, outside of the extensive gallery forests located along the Willamette River and its major tributaries, was a prairie or prairie/oak savannah. Prairie also extended up the valleys of many of the smaller tributaries including the Long Tom River and many of its tributaries. This extensive grassland was maintained and perhaps owed its origin at least in part, to anthropogenic fire. The Kalapuya peoples who inhabited the valley above the Falls of the Willamette used fire as a land management tool and the periodic burning of the prairie killed young tree seedlings keeping the area outside of the bottom lands, marshes, and swamps free of most trees.

Marsh Land as defined in this document consisted of permanently flooded land with herbaceous emergent vegetation. The only marsh identified in the Long Tom Watershed lay along the course of Amazon Creek.

Swamps are areas covered with standing water all or most of the year. The main overstory vegetation in the swamps located in the Long Tom Watershed was willow. Large tracts of swamp were observed along the lower courses of Ferguson Creek and Bear Creek, and on Coyote Creek just upstream from the confluence of the Long Tom and Coyote Creek. Smaller areas of swampland were observed along Coyote Creek tributaries and in the headwaters of Coyote Creek.

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Ash & Shrub Riparian zones are areas of streamlined vegetation in which the overstory consists of Oregon ash.

Scattered Oak refers to savannah-like settings with widely spaced specimens of Oregon white oak and California black oak. The majority of the area classified as scattered oak was located in what are now called the South Eugene Hills and the eastern edge of the valley of Coyote Creek downstream from the junction of Coyote Creek and Spencer Creek. Savannahs in the Long Tom Watershed were formed and maintained by the same anthropogenic fires that produced and maintained the prairies on the valley floor of the watershed.

Scattered Douglas-fir and Oak refers to savannah-like settings with Douglas-fir and Oregon white oak and/or California black oak.

Scattered Ponderosa Pine, Douglas-fir, and Oak refers to savannah-like settings with ponderosa pine, Douglas-fir, and Oregon white oak and/or California black oak.

Scattered Douglas-fir refers to savannah-like settings with Douglas-fir. Most of this vegetation type was present on rolling uplands in the western portion of the watershed.

Mature Conifer Forest (Douglas-fir dominated) refers to well stocked conifer stands where the most common tree species was the Douglas-fir.

No Data refers to the 1,261 acres in the extreme northern portion of the watershed that lie outside of the Eugene District BLM boundary and for which the District has no records.

DISTURBANCE REGIME - The prairie and prairie/savannah vegetation that extended over approximately 80 percent of the Long Tom Watershed in the mid-19th century may have been the product of anthropogenic fire. The Kalapuya, who inhabited the Willamette Valley south of the Falls of the Willamette when the first Euro-American explorers arrived, utilized fire as a land management tool. David Douglas, an English botanist who accompanied a Hudson's Bay trapping expedition into the Willamette Valley in the fall of 1826, made a number of diary entries noting the burned prairies and the absence of fodder for the expedition's horses (Lavendar 1972). John Work, a Hudson's Bay employee, observed Kalapuya firing the prairie during the fall of 1834 (Scott 1923).

The Kalapuya used fire for many purposes: to drive game, to reduce competition to edible plants, to ready tar weed for harvest, and to clear undergrowth. Fires set on the prairie periodically burned into the forested hills adjacent to the prairies. Depending upon fuel loads and weather, fires that burned into forested tracts might assume the form of cool-burning ground fires that reduced brush and killed seedlings and saplings, or they might evolve into stand replacement burns that could killed all but a few trees in the affected area. However, most areas appear to have burned often enough that fuel loads remained low and most burns were relatively cool ground fires. The fact that GLO surveyors did not record any deforested burns in the Long Tom Watershed while working there during the mid-19th century can be taken as evidence that fire frequency served to keep fuel loads low and promote cool burns.

Table 3-1 - Early Historic Period Vegetation Types (approximate acreage in the Long Tom Watershed)

Prairie	80,459 acres (30.6%)
Marsh	1,345 acres (0.5%)
Ash & Shrub Riparian	804 acres (<0.5%)
Ash, Oak and Shrub Riparian	6,846 acres (2.6%)
Swamp (willow, ash, alder)	5,075 acres (1.9%)
Scattered Oak	13,558 acres (5.2%)
Scattered Douglas-fir and Oak	45,545 acres (17.3%)
Scattered Ponderosa Pine, Douglas-fir and Oak	46,974 acres (17.9%)
Scattered Douglas-fir	26,615 acres (10.1%)
Mature Conifer Forest (Douglas-fir dominated)	34,267 acres (13.0%)
No Data	1,261 acres (0.5%)
TOTAL	262,749 acres (100.0%)

Normally stocked, mature conifer forests were limited to the western fringe and one point on the southern fringe of the watershed. This distribution reflects the usual limits of anthropogenic fire originating in the prairie/savannah zone to the east.

Because the Long Tom Watershed was located along the western margin of the Willamette Valley and contained large stretches of level prairie, the lower reaches of the Long Tom Watershed were attractive to early Euro-American settlers from the eastern and mid-western states. The area was also attractive because the road to the California gold fields traversed the watershed and settlers could sell any surplus produce to travelers who passed by on their way to California. The earliest settlements were Donation Land Claims filed on land along the west side of the Long Tom River. Land along the west side of the river was not prone to flooding, and the road to California was immediately adjacent. Some of these claims were staked as early as 1849 but none of the parcels of enclosed and/or cultivated land were large enough to place on the map with accuracy.

1930s - The Long Tom Mid-1930s Vegetation Map presents the pattern in the Long Tom Watershed as it appeared at that time. This map is derived from a forest type map compiled by the USDA Forest Service, Pacific Northwest Experiment Station, and published in 1936. Data for the 1936 map was gathered beginning in 1930 using field reconnaissance and intensive survey techniques and county and private harvest records. Eight "forest types" are recognized in the watershed. A ninth "no data" category applies to the extreme northern portion of the watershed.

Vegetation patterns in the Long Tom Watershed had changed in the 80 years between the middle of the 19th century and the mid-1930s but not to the same extent exhibited by watersheds originally containing greater percentages of forested land. Table 3-2 presents vegetation classes and the acreage each comprises as well as the percentage of the total acreage in the watershed for the mid-1930s.

Some differences between the observed vegetation patterns of the early historic period and those of the mid-1930s are due to the use of different classification systems or terminology. Deputy surveyors working during the middle of the 19th century portrayed the vegetation they encountered in descriptive terms but with little eye to commercial value. Forest Service employees who compiled the 1936 forest type map upon which Long Tom Mid-1930s Vegetation map is based organized the vegetation into commercial forest types and some residual categories that reflected noncommercial forest land, timber harvest status, and recent forest fires. Thus, the 1936 forest type map does not include the "scattered timber" types of vegetation that covered large portions of the watershed during the early historic period. Instead these areas are typed as Douglas-fir second growth stands (Douglas-fir being the major commercial saw timber species).

NONFORESTED land includes the area previously classified as prairie as well as land cleared for agricultural purposes in the intervening 80 years. The nonforested land accounts for approximately 56 percent of the land base in the mid-1930s. This is an increase of approximately 25 percent.

Table 3-2 - Vegetation Classes and Approximate Acreage - mid-1930s

Nonforest	**147,630 acres (56.2%)**
Douglas-fir (old growth)	**22,254 acres (8.5%)**
Douglas-fir (large second growth)	**14,269 acres (5.4%)**
Douglas-fir (small second growth)	**49,681 acres (18.9%)**
Douglas-fir (seedlings and saplings)	**1,479 acres (0.6%)**
Hardwoods (oak and madrone)	**2,370 acres (0.9%)**
Hardwoods (ash, alder and maple)	**1,308 acres (0.5%)**
Recent cut over	**17,024 acres (6.5%)**
Deforested burn	**5,473 acres (2.1%)**
No data	**1,261 acres (0.5%)**
TOTAL	**262,749 acres (100.0%)**

Douglas-fir (old growth) accounted for about 8 percent of the land base in the mid-1930s compared to 13 percent of the land base in the mid-19th century. The differences reflect timber harvested after 1920 and timber destroyed by forest fire.

Douglas-fir (large second growth) accounts for approximately 5 percent of the land base. No comparable vegetation class exists in the Early Historic classification scheme.

Douglas-fir (small second growth) accounts for approximately 19 percent of the land base. No comparable vegetation class exists in the Early Historic classification scheme.

Douglas-fir (seedlings/saplings) accounts for less than 1 percent of the land base. No comparable vegetation class exists in the Early Historic classification scheme.

Hardwoods (oak and madrone) accounts for approximately 1 percent of the land base. During the Early Historic period an oak component (and almost certainly a madrone component, as well) was present in three of the widespread classification units: scattered oak, scattered oak and Douglas-fir, and scattered oak, ponderosa pine, and Douglas-fir. The "Hardwood (oak and madrone)" forest type probably represents the areas included in one of the Early Historic period oak component classifications where Douglas-fir was not replacing the oak.

Hardwoods (alder, ash, maple) accounts for less than 1 percent of the land base. This forest type is comparable to the two riparian vegetation classes present in the Early Historic vegetation classification system. It appears that the compilers of the 1936 forest type map did not map the gallery forest along the lower reaches of the Long Tom River and, if so, this would account for most of the acreage difference between the Early Historic period and the mid-1930s.

Recent cut over land maps timberlands harvested between 1920 and the period in the early 1930s when field work for the forest type map was carried out. Approximately 6 percent of the land base had been logged between 1920 and the early 1930s.

Deforested burns are just that - timberland destroyed by forest fires. It is assumed that the fires occurred in the 10 to 15 years preceding the compilation of data on which the 1936 forest type map was based. Approximately 2 percent of the land base was classified as this type.

No data accounts for less than 1 percent of the land base. The no data classification covers the area at the extreme northern end of the watershed that lies outside of the Eugene District boundary.

DISTURBANCE REGIME

The Douglas-fir second growth forest types, which on the mid-1930s forest type map cover much of the area classified as one of the "scattered" timber types in the Early Historic period vegetation map, illustrate the succession of Douglas-fir in these stands once fire was excluded. Douglas-fir was always a constituent of the scattered timber types although a very minor constituent of the scattered oak classification. Once the presence of Euro-American settlers in the watershed forced the Native American inhabitants to stop annual burning, seedlings and saplings of Douglas-fir and other species survived to increase the stocking level of the various stands. This marks a major reduction in the disturbance regime in the watershed.

Post-1920 timber harvest covering some 17,000 acres or 6.5 percent of the watershed represents a new factor in the disturbance regime within the watershed. Much of the harvest activity occurred in the area immediately west of Veneta, in the area around Vaughn, and the area around Badger Mountain. Each of these locations is adjacent to the branch line railroad between Eugene and Coos Bay completed in 1916. Smaller concentrations of timber harvest were located in the Swamp Creek drainage in the SE corner of T. 16 S., R. 6 W. and in the Battle Creek drainage in the Secs. 15, 16 and 22, T. 19 S., R. 5 W. Each of these locations is associated with a previous mill site.

There certainly was logging in the watershed prior to 1920 but it appears that much of this was done in conjunction with land cleared for agricultural purposes as no pre-1920 harvest units are identified on the 1936 timber type map. Consulting a timber type map published by the State of Oregon in 1914 shows only 2 identified harvest units in the watershed at that time. One of these is located in the headwaters of Hannavan Creek and the other in Sec. 31, T. 17 S., R. 6 W., W.M. Both are shown as cut over, not restocked (Elliott 1914).

Wildfire is another disturbance agent that had an affect on the watershed, which was captured on the 1936 timber type map. The majority of the burned acres are located on the western edge of the watershed in the upper January Creek, Hays Creek, Poodle Creek, and Hayes Creek drainages. This burned acreage is part of a larger area in the upper Lake Creek Watershed that burned during September of 1929 (Western Lane District, Oregon Department of Forestry, n.d.).

SOIL EROSION

Mass Wasting or the downslope movement of soil and rock material through a variety of landslide movement types (shallow rapid translational failures, debris avalanches, and torrents) is a dominant physical process that created the land forms, which make up the foothills of the Long Tom Watershed. Mass wasting is a natural process within the watershed, although the natural frequencies and magnitudes can be influenced by human activity. The volume of mass wasting events can range from a few cubic feet to thousands of cubic yards. Mass wasting is an integral supplier of essential materials to downstream ecosystems, but it can also scour stream channels free of needed structure to the detriment of downstream ecosystems. Major concerns and impacts of mass wasting occur off-site, e.g., public safety, private property, roads, bridges, water quality, and fisheries.

Some of the more important factors that contribute to soil/slope instability are steep gradient; low soil strength; declining root strength; ground water accumulation and alteration of natural water routing; and a high frequency, duration, and intensity of precipitation.

Shallow translational failures are the predominant type of mass wasting activity in the foothills of the Long Tom Watershed. These translational failures can create fast moving, water charged debris torrents composed of soil, rock, and organic material that flow down the steeper drainages and end on gentler gradients as debris deposits. These failures are the predominant process that scour the steeper, upper reaches of streams and deliver sediment (and structure) to the gentler lower reaches. The Slope Stability Risk Map displays these areas for the entire watershed.

Table 3-3 - Slope Failure Potential Summary

Slope Failure Potential	Acres	Percent of Watershed
Low	83,429	85.6
Moderate	10,294	10.6
High	3,695	3.8
Totals	97,418	100

Gravel and larger boulder material have been supplied to the stream system by landslides. Although landslides impact a small percentage of the land base, they can have significant impacts on water quality and fish habitat. Ninety percent of landslides originate on slopes of 75 to 100 percent because the slope angle determines the partitioning of the force of gravity in the weight of the soil mantle into a downslope component that promotes instability through its effect on frictional resistance. Slides can occur only when slopes are steep enough for other factors to combine and produce a stress that exceeds the resistance to sliding.

The soils in this watershed are considered cohesionless soils, which are predominantly silt, sand, and gravel-size fractions with minimal amounts of clay. Individual particles are influenced primarily by gravitational forces (which are partitioned into failure promoting or stability promoting forces by slope angle) and forces due to the movement of water into and through the soil profile. In cohesionless soils the resistance to sliding, other than that which results from gravitational forces in combination with slope angle, is almost exclusively the result of intergranular friction and the interlocking of soil grains. Particle size distribution and the angularity of soil grains control the amount and effectiveness of interlocking within a soil mass. The greater the angularity and the wider the range of particle sizes, the greater the interlocking forces. The "angle of internal friction" is simply an index of the intergranular friction and interlocking of soil grains. It is an index that represents the frictional resistance to sliding, and is primarily a function of the arrangement, angularity, effective size, and surface roughness of the soil grains as well as the gradation (Harr and Yee 1975; Bishop and Stevens 1964; Sanston 1970). This angle generally varies from 30 to 34 degrees for soils in this watershed.

These soils form and rest at angles or percent slopes beyond this angle of internal friction because of factors that lend additional resistance strength to the soil mantle, such as the root masses of trees and brush. Soils in this watershed fail at percent slopes or angles below the angle of internal friction due to factors that reduce the resistance to sliding, such as exceptionally high subsurface water flow. Pore water pressure within the soil profile is the primary force that lowers this angle of repose for soil materials so that more then 80 percent of the landslides in the Coast Range,

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including this watershed, occur or originate in land form positions where the concentration of subsurface water is the greatest.

Studies in the Coast Range on the Mapleton Ranger District have shown that headwalls (26%), channels and incipient channels (31%), and over steepened stream-adjacent side slopes (26%) account for 83 percent of the slope failures. Headwalls produced all failures over 100 cubic yards. These data on landslide origin are somewhat applicable for the foothills of the Long Tom watershed, though total precipitation and steepness of slopes is much less close to the Willamette Valley than farther out in the Coast Range. All of these land form positions are segments of the landscape that receive and transport water through and over the land to the stream system. These are the land form positions receiving the greatest concentration of subsurface flow and subsequent pore water pressure. What little cohesion that the soils initially have is due to capillary tension. As water enters the soil and fills the pores, capillary tension is reduced. Seepage pressures of percolating ground water result from viscous drag between liquid and solid grains. If the rate by which water infiltrates into the soil exceeds the rate by which the water can percolate through the soil, then a free water surface develops (piezometric surface). Pressure at the free water surface equals zero. It is thus free of downslope gravitational pressures and capillary tension. As this free water surface rises it is able to exert pressure of its own. These new pressures are upward and also against the interlocking grains of the soil. Positive pore water pressure resulting from saturated flow can significantly decrease a soil's shear resistance by reducing the portion of the soil mass weight that is holding the mass against the slope and contributing the frictional resistance to sliding. The smaller the slope angle, the more of this weight that is contributing to stability and the less likely that pore water pressure will be destabilizing (Ketcheson and Froehlich 1978).

Reduction in root strength following timber harvest and site preparation activities is likely a significant cause of landsliding outside the area of road construction. This change matches the high frequency of landslides the first few years following timber harvest on slopes with high potential for failure in western Oregon (Burroughs and Thomas 1977). Areas most sensitive to loss of root strength and subsequent landsliding usually are steep (75%+) slopes in concave positions over hard bedrock in areas of high rainfall. These areas are mapped in the "high" category for slope failure potential (see "Slope Stability Risk" map). The natural rate of landsliding in this watershed was probably influenced by fire. Translational failures most likely were triggered when a stand replacement fire removed vegetation from areas susceptible to landsliding, followed by a storm intense enough to provide enough water to create positive pore water pressures at the period of time (3 to 10 years after vegetation removal) when root strength was lowest. Past resource management practices have created similar situations, although these practices have been greatly curtailed in the last 20 years.

Mass wasting potential was analyzed and mapped utilizing a model for the topographic influence on shallow landslide initiation developed by coupling digital terrain data with near surface through flow and slope stability models (see Appendix A) (Dietrich, Wilson, Montgomery, and McKean 1993). The areas mapped in the "High" category for slope failure potential are those areas that, relative to the rest of the watershed and given the modeling components and concepts, indicate the inherent potential for slope failure. On-site investigations for project level planning will be necessary in order to determine if a specific site is actually unstable and requiring mitigation or the avoidance of a particular activity or practice.

The BLM lands in the Coast Range were field-inventoried over the last 15 years for actual sites of instability, including sideslopes on 1st and 2nd order streams. As a result of these field inventories, 456 acres, or 1 percent of the BLM acreage, was identified as potentially unstable based on field indicators and factor of safety modeling. This acreage has been classified as Fragile Gradient Nonsuitable Woodland (FGNW) and withdrawn from management activities.

An inventory identifying segments of roads likely to create slope instability was conducted for BLM controlled roads in the early 1980s. Corrective action has been accomplished for all the segments identified as suspected of creating instability. Therefore, it is concluded that slope instability created by BLM roads is minimal in the watershed. All major storm events result in a road repair workload due to cut/fill slope and culvert failures though this has diminished substantially as the road system has matured since construction in previous decades. Even with the road damage in the Coast Range Resource Area (BLM) from the extreme storm events of the 1995/1996 and 1996/1997 winters, benefits from stream alterations caused by the floods were considered greater than negative impacts on fish habitat, including the constructed habitat features (Neil Armantrout, Eugene District fishery biologist). Road repair projects were significant from an administrative/managerial perspective but not from the standpoint of biological/physical resource values.

The nearest data on mass wasting frequency and volumes is from the Mapleton Ranger District inventories on the Siuslaw National Forest. This data is not relevant to this watershed as it is from a zone of substantially greater storm intensity, frequency of storm events, and total annual precipitation. That data is also reflective of management practices of a couple of decades ago that included side casting of road construction materials on steep slopes, including into headwall zones of concentrated subsurface flow; inclusion of headwall zones and steep stream side slopes in timber harvesting; and hot intense burns to rid the sale units of logging slash and to kill the roots of brush species. Side casting was abandoned by private industry and the public agencies on steep land in the mid-1970s. The BLM does not cut timber within or adjacent to potentially unstable slopes within headwalls or on over-steepened stream-adjacent side slopes.

Road Related Erosion & Sediment Production Assessment - Understanding road sediment requires that the road system be stratified by its ability to deliver sediment to a stream, by the quality of its surfacing, and by traffic levels impacting the road surfacing (Sullivan and Duncan 1980). Roads can be a significant source of sediment to streams in forests, and this sediment can be detrimental to stream ecosystems. Traffic and maintenance grading rejuvenate the supply of fine sediments and thus make roads a potential long-term source of sediment to streams. The costs of total road erosion control or capture of all road derived sediment is prohibitive and, in most locations, unnecessary because the forested slopes below the road capture and store much of the sediment (Reid and Dunne 1984; King and Luce, USFS Intermountain Research Station). Key to predicting if road segments provide significant sources of sediment to streams is determining the "connectedness" of road drainage to stream channels.

The Washington Forest Practices Board (1993) noted "The delivery of road erosion products to the stream system is key to understanding the influence of roads on the stream system . . . Although all roads generate erosion, only a portion of the road system drains into the stream system . . . . It is important to determine what proportion of the sediment from a road system is delivered to streams in order to evaluate the contribution of road surface erosion to downstream resources."

A comprehensive field inventory indicated that 88 percent (575 miles) of the road network in the foothill fringe of the Long Tom Watershed does not have the potential to deliver sediment to stream channels. However, it was determined that 12 percent (75 miles) of this road network does have the potential to deliver sediment to streams.

The Washington Forest Practices Board (1993) methodology partitions road sediment by origin with 20 percent coming from fill slopes, 40 percent from cut slopes and ditches, and 40 percent from the road surface. Fill slopes without total vegetative cover are rare in these drainages. Only 12 percent (75 miles) of the road network in this watershed has the opportunity to deliver sediment to a stream channel, and only 6 percent of the 75 miles has cut banks that have less than 80 percent vegetative cover. Thus, fill slopes play a negligible role, cut banks contribute on 5 miles of the road network, while the road surface is a significant factor on 75 miles of the road network.

Traffic levels are low on road segments capable of delivering sediment.

Most roads in the foothills of the Long Tom watershed and 85 percent of the road segments with sediment delivery potential are rock surfaced. Typically this includes a lift (approximately 6-8 inches) of pit run (larger stone fragments) and a lift (4-6 inches) of crushed gravel with high aggregate quality. This is a significant factor working on behalf of water quality in this drainage. Kochenderfer and Helvey (1987) showed an 88 percent reduction in sediment with a 6-inch lift of 1.5 to 3.3 inch rock, and a 79 percent reduction in sediment with a 6-inch lift of gravel smaller than 1.5 inches. Swift (1984) showed a 97 percent sediment reduction with an 8-inch lift of large stone and a 92 percent sediment reduction with a 6-inch lift of crushed 1.5 inch minus gravel. Swift (1984) found sediment production reduced by 84 percent with a combination of rock surfacing and established grass cover up to the road edge. Burroughs et al. (1985) had similar results with a reduction of 79 percent from rock surfacing (also see Burroughs and King 1989).

Annual sediment yield for roads in the foothill fringe of the Long Tom Watershed was calculated using the methodology given in the Washington Forest Practices Board (1993) watershed analysis standards, an approved methodology for federal watershed analysis. Total sediment delivered to streams in the foothill fringe of the Long Tom Watershed from roads is estimated to be 1,816 tons per year.

The background sediment yield for the foothill fringe of the Long Tom Watershed is estimated to be 39,280 cubic yards per year (see below). Therefore, the estimated delivered sediment related to road erosion is equivalent to less than 4 percent of the background level. Relative to natural fluctuations and the capability of current technology to accurately estimate background and road contributions, a 4% increase is a negligible amount. Confidence in the determination of sediment

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contributing road segments is high because all accessible roads were field inventoried. The variables with the least confidence are sediment delivery rates and estimation of background sediment levels. The Washington State Forest Practices Board methodology utilized here is a regional system for the Northwest approved in federal guidelines for watershed analysis.

The Bureau of Land Management, National Council for Air and Stream Improvement(NCASI) and the USFS Rocky Mountain Research Station are conducting a 5 year/$500K research effort to establish rates/model localized to Western Oregon. Under the Washington State methodology relief culverts within 200 feet of a stream channel are considered contributing. The Western Oregon study shows an average travel distance of 30 feet and a maximum of 130 feet. Early data from the Western Oregon Study indicates that the Washington State methodology overestimates sediment from roads by as much as 2 to 10 times the actual amount. Thus, the rates reported here are likely much lower than even the relatively small amounts reported. This analysis does not address sediment from roads due to mass wasting.

Natural Background Sediment Production - In a study of the Coast Range, Reneau and Dietrich (1991) found ". . . average bedrock lowering rates of about 0.07 mm/year for the last 4,000 to 15,000 years. These rates are consistent with maximum bedrock exfoliation rates of about 0.09 mm./year . . . . Sediment yield measurements from 9 Coast Range streams provide similar basin wide denudation rates of between 0.05 and 0.08 mm/year, suggesting an approximate steady state between sediment production on hill slopes and sediment yield. In addition, modern sediment yields are similar in basins varying in size from 1 to 1500 km^2, suggesting that erosion rates are spatially uniform and providing additional evidence for an approximate equilibrium in the landscape."

Utilizing the work of Reneau and Dietrich (1991), a natural sediment yield for the foothill fringe of the Long Tom Watershed was determined to be approximately 39,280 cubic yards per year. Surface erosion is not a significant factor under natural conditions given the lush vegetation and porous soils of the Coast Range and the almost total lack of surface runoff outside of stream channels. Roads are obviously not a factor in natural, presettlement yields. It is assumed that this natural background sediment yield is made up almost entirely from soil creep and mass soil movement.

HYDROLOGY

CURRENT CONDITIONS - The range of natural variability in climate conditions for Western Oregon is rather large. Western Oregon weather cycles between cool wet periods and warm dry periods. According to George Taylor, the state climatologist, we are presently in a cool wet cycle, see Appendix E. Climate records for two stations are available, they are at the Eugene airport and at Fern Ridge Dam. These are both in the drier portions of the watershed but the relations would be similar to the entire watershed. November, December, and January are the wettest months of the year and July and August the driest, with January being the coldest and most likely month for snowfall (see Appendix E). Snowfall is not a common form of precipitation in this watershed as the watershed is at lower elevations. Only 9 percent of the watershed is above 1000 feet. The largest number of high daily rainfall amounts comes in December and

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January. Records for the station at the Eugene airport for the period from 1939 through 1996 showed 9 days of rainfall over 3 inches for these two months with only 4 for November, 3 for February and October, and none for March (see Appendix E).

USGS stream flow records for the Long Tom River near Noti and Coyote Creek near Crow show that the percent of average annual runoff is about a month behind precipitation. These two stations are above the dam so they are not regulated during high flows although Coyote Creek does have some irrigation diversions up stream. The November flow is only 7 percent of annual runoff yet this is one of the highest months for precipitation. This is probably due to soil storage not being fully restored at this time. December, January, February, and March are the months with the highest runoff. July, August, and September are the months with the lowest monthly rainfall with 0 percent runoff in Coyote Creek in August. The flows below Fern Ridge Dam have been altered with higher average monthly flows for August through November and lower flows in late winter and spring compared to pre-dam years.

Complete surveys of large woody debris in channels are not available. Where streams have been observed there appears to be a lack of large woody debris. ODFW did stream surveys on Bear and Ferguson creeks that included LWD counts. The potential for recruitment of large conifer logs in the future would come mainly from the adjacent stream banks as only a small portion of the fringe area has a potential for landslides delivering material to the streams. The opportunity for large conifer woody debris to enter the streams in the near future is poor. GIS data indicates only about five percent of the streamside forest have a high potential to deliver large conifers to the streams.

WATER QUALITY - There are four water rights on BLM land in this watershed, three for domestic use and one for irrigation. Water in the valley portion is heavily used for water contact recreation, fishing, and boating. If water is protected to the point that it will support salmonid fisheries it will support these other uses as well. There are three streams in the watershed that are listed on the State 303(d) list of water quality limited streams. These are the Long Tom from the mouth to Fern Ridge reservoir, Coyote Creek from the mouth to the head waters, and the Amazon Creek Diversion Channel. Fern Ridge reservoir is also on the list. They are listed for bacteria, dissolved oxygen, turbidity, and temperature. There is little data available for the fringe area of the watershed as most of the water monitoring has occurred in the valley portion of the watershed. This is where most of the water quality problems exist. One study on the upper Long Tom near the headwaters reported no water quality problems. For a more complete look at water quality in the entire Long Tom watershed contact the Long Tom Watershed Council for their report on water quality in this basin.

FISH HABITAT

Past conditions for fisheries in the Long Tom River Watershed are usually from BLM records prior to 1999 as included in this analysis, whereas present conditions are primarily for 1999 observations by BLM, as briefly recorded at various locations. Additional sources of information are recorded as references for this analysis.

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As recorded by the Bureau of Fisheries, during a 1938 survey much of the Long Tom River had high amounts of mud and silt, low spawning gravel, and high water temperatures. Hardwoods, brush, second growth trees, and agricultural lands were near the stream. Second growth trees had often been cut above Elmira. Fallen trees and brush were in the channel at frequent intervals along lower reaches of the river. A mill dam about 5 miles above Noti was considered impassable for any salmon. A few salmon had been reported to use the stream, although this information was indefinite (Fern Ridge Dam was being constructed at the time of this survey.).

In 1959 the Long Tom River was surveyed by the Fish Commission of Oregon from Monroe up to Fern Ridge Dam, and the stream also was observed at intervals upstream from Fern Ridge Reservoir. Stream bottom composition was primarily mud and silt with some bedrock and low amounts of gravel. A concrete dam at Monroe had a concrete ladder for fish passage. Two more concrete dams without ladders were located above Monroe. No fish ladder had been installed farther upstream at Fern Ridge Dam. Brush and small trees provided a fair amount of shade along the Long Tom River. Much of the watershed also contained agricultural lands. No salmon or steelhead were known to spawn in the stream, although lower portions of the system could have been used for rearing by juvenile salmon. Cutthroat trout and warm water fish were present in the river.

The Long Tom River was viewed by BLM in 1970 at a few locations near Vik Road and farther downstream to Alderwood Park (Oregon State Park). The stream had an estimated 55 percent pool and 45 percent riffle where observed near Vik Road. Low to moderate amounts of gravel and rubble were available, and silt was moderate to high. Brush, hardwoods, and conifers were along the stream.

About a mile downstream, there was about 50 percent pool and 50 percent riffle, with rubble and gravel in the channel. Hardwoods were in the riparian area. Farther down at Alderwood Park, 55 percent pool and 45 percent riffle were recorded. Some gravel and large rocks were in the channel. The riparian area contained conifers and hardwoods.

Past fisheries information for upper Long Tom River was recorded in a BLM stream survey during 1972 when this stream was surveyed from the lower edge of BLM within T16S, R6W, Sec 7 upstream for 1.25 miles. Fish species estimates were 6-50 cutthroat trout and 6-50 sculpin per 100 ft. of stream. Spawning area records were 640 sq. yds. of good gravel and 1,405 sq. yds. of marginal gravel. Rearing habitat included 2,300 sq. yds. of pools, with 40 percent pool where the stream was surveyed. Stream gradient was moderate (1-2.5 percent). Average stream area shade was 80 percent. Stream side cover types included old growth conifers throughout most of the survey in addition to hardwoods, except one area near the upper end that had been logged within the previous 5 years. Several log piles and beaver dams were present. One falls 5 ft. high was recorded. Moderate to high silt was observed in the stream channel. An arch culvert 6 ft. high was 1090 yds. up from the beginning of BLM, and a 4 ft. high culvert with a 2 ft. drop at the outfall was recorded 310 yds. farther upstream.

A main tributary to the Long Tom River adjacent to Vik Road was surveyed along 1.25 miles of stream in 1973, beginning at the lower edge of BLM in T16S, R6W, Sec 19. Cutthroat trout were estimated at 6-50 fish per 100 ft. of stream where recorded. Spawning gravel included 505 sq. yds. of good gravel and 965 sq. yds. of marginal gravel. Pools and beaver pond areas were 12,890 sq. yds along 50 percent of the stream. Silt in the channel ranged from low to high. A low falls and bedrock were observed near the upper end. Beaver dams, marsh areas, scattered log piles, and several log jams were recorded. About 50 percent of the stream was shaded. Nearby vegetation included hardwoods and areas that had been logged within the previous 5 years, except old growth conifers also were recorded near the upper end of the survey.

Upper Long Tom River was observed in 1999 on parts of BLM land in T16S, R6W, Sec 7 where cutthroat trout and sculpin were found when netting. Habitat types included pools and riffles, with channel substrates of gravel, sand, silt, and rubble. Logs and wood debris varied from low to high amounts, resulting in fair to good structure for fish cover. Brush, hardwoods, and large conifers were within the riparian area. A culvert at Road No. 16-6-7.2 had gravel and rubble covering the bottom, and fish passage conditions were adequate.

Farther upstream, Road No. 16-7-1.1 had washed out at a culvert, and boulders are located at the upstream edge of this site (resulting in some erosion control and a partial obstruction to fish passage). Sculpin were found in 1999 above this road where habitat includes riffles and pools with gravel, sand, silt, and rubble. Moderate amounts of logs and wood debris provide structure and cover. Riparian vegetation includes second growth conifers, brush, and hardwoods. A power line is located along the stream below this crossing, and riparian vegetation has been impacted within this right-of-way. Cutthroat trout were netted farther upstream in a tributary within section 1, SE1/4.

Downstream from the above locations, Long Tom River habitat was described near a bridge at side Road No. 16-6-17.1 across from Triangle Lake Maintenance Shop near the boundary line between sections 17 and 18. Most habitat is within a long pool area where high amounts of silt and sand are in the channel, and low to moderate amounts of wood are available. Riparian vegetation includes hardwoods, brush, and second growth conifers.

Farther downstream in T16S, R6W, Sec 33, NW1/4 near another bridge on Lane County Road 4348, the stream has mostly bedrock riffles with low amounts of pool. Cobble, gravel, sand, rubble, silt, and wood also are in the channel. Hardwoods, brush, second growth conifers, and a field are within the riparian area.

Between the above two locations, riparian vegetation includes large conifers at the Oregon State Park in addition to hardwoods and brush. Some large logs are in the channel that contains low to moderate amounts of logs and wood debris. Riffles, pools, and glides contain sand, silt, gravel, rubble, cobble, and a few boulders.

In the Long Tom River above Fern Ridge Reservoir there is a dominance of pool habitat and riparian vegetation consisting of hardwoods, brush, second growth conifers, some larger conifers, and fields. Much sand and silt is present, and a high percentage of the streambanks are eroded. Moderate amounts of logs and wood debris are available for cover and structure. Cutthroat trout have been known to move up from the reservoir into the river during summer, as recorded by ODFW. Warm water game fish and other fish species also inhabit the lower part of the river, as well as the reservoir. Fisheries and habitat in and below Fern Ridge Reservoir are briefly described under "Characterization" in this analysis.

The main tributary to the Long Tom River adjacent to Vik Road was described in 1999 on BLM land in parts of section 19. Cutthroat trout and sculpin are present in this drainage. Above Road No. 16-6-19 this tributary contains pond and marsh areas with silt, moderate wood debris, and low numbers of logs. Riparian vegetation includes aquatic ground cover, brush, hardwoods, and second growth conifers. Farther upstream about 0.5 mile, there are pools, riffles, and glide areas with rubble, gravel, silt, sand, cobble, and boulders. Stream banks are partly eroded. Moderate to high amounts of wood debris and logs are in the channel. Vegetation adjacent to the stream contains hardwoods, brush, and second growth conifers.

Ferguson Creek

A main tributary to Ferguson Creek was observed in 1988 on BLM land in T15S, R6W, Sec 27, S1/2, upstream from Road No. 15-6-26.2. This stream contained mostly riffle with some pool and glide areas. Gravel, rubble, cobble, silt, sand, and boulders were in the channel. Scattered wood debris and logs also provided cover. Riparian vegetation consisted of hardwoods, brush, and small to large conifers. Cutthroat trout and sculpin were found by netting above the road.

During 1998, fish found by shocking in Ferguson Creek within T15S, R6W, Sec 15 and a main tributary on BLM in section 27 included cutthroat trout, sculpin, and lamprey. Some of the smaller trout may have been rainbows as recorded. Habitat types were riffles, glides, and pools where inventoried along 788 feet of these streams. Several of the pools were caused by wood in the channels. Hardwoods, second growth, and relatively large conifers were in the riparian areas.

Upper Ferguson Creek has riffles, glides, rapids, and pools in T15S, R6W, Sec 15, N1/2, where recorded in 1999. The channel has bedrock, sand, gravel, rubble, and cobble. Low amounts of wood debris and logs are present. Riparian vegetation includes ground cover, brush, hardwoods, second growth conifers, and few large conifers. Part of the nearby trees had been cut recently. Cutthroat trout spawn and rear in this stream, as identified during netting.

Farther downstream near the boundary line of sections 14 and 15, the riffles and pools contain bedrock, rubble, sand, gravel, and cobble. A low amount of wood debris is present in the channel. Riparian vegetation contains brush, hardwoods, second growth conifers, and few large conifers. At another location farther downstream near the east boundary of section 23, there are pools and riffles with silt, sand, and gravel. Moderate accumulations of wood debris and logs are in the channel. Part of the streambanks are eroded. Vegetation includes brush, hardwoods, and fields.

Lower Ferguson Creek near Territorial Highway contains pools, except where riffles and rapids are formed by boulders and cobble (riprap) near the bridge. The water was turbid when observed in May of 1999. Riparian vegetation includes brush and hardwoods, with fields located nearby.

The main tributary to Ferguson Creek on BLM land in section 27, SE 1/4 was described in 1999 just upstream from the crossing at Road No. 15-6-26.2. Primarily riffles and a few pools contain gravel, rubble, sand, silt, and cobble. Low amounts of wood debris and logs are in the channel. Vegetation adjacent to the stream consists of hardwoods, brush, and large conifers. Small conifers and brush are in an old clear cut outside of the riparian area. The culvert at the above road has a drop at the outfall and a steep gradient. Another culvert has a drop at the outfall at Road No. 15-6-26 in section 26, NW1/4.

Owens Creek

In 1984 Owens Creek was observed near Smyth Road, where the stream contained about 50 percent pool, low gravel, and high silt. Hardwoods and brush shaded part of the stream, which flowed through a pasture. More hardwoods were farther upstream.

Fish species recorded in Owens Creek during an electro-shocking survey in 1998 were cutthroat trout, sculpin, and lamprey. Riffles, glides, and pools were recorded where inventoried along 373 feet of stream in T15S, R6W, Sec 35, S½. One pool was caused by large wood in the channel. Hardwoods and second growth conifers were in the riparian area.

Upper Owens Creek drainage areas on BLM land were briefly observed in T15S, R6W, Sec 33 during 1999. Part of the drainage has a clear cut with small conifers and brush. Larger conifers and hardwoods are downstream from this clear cut and also adjacent to a nearby tributary.

Cutthroat trout and sculpin were found in 1999 when netting downstream from BLM land near the south boundary of section 35. Owens Creek riparian vegetation contains hardwoods, brush, second growth, and few relatively large conifers at this location. Pools and riffles contain silt, sand, gravel, rubble, and cobble. Low amounts of wood are scattered along the stream. A pool backs up through a culvert on County Road 3455, where there is no problem for fish passage. Below this location in section 35, SE1/4, pond and marsh areas contain high silt, sand, and moderate to high wood debris and logs. Vegetation includes brush, aquatic plants, and second growth conifers. Low to partial shade is provided by the vegetation.

Owens Creek near Smyth Road contains primarily pools with silt, sand, and eroded banks. Hardwoods, brush, fields, and pasture are within the riparian area. The stream is only partly shaded by stream side vegetation. Lower Owens Creek near Territorial Highway has pools with eroded banks, silt, sand, and gravel. Brush, hardwoods, and fields are near the stream.

Jones Creek

This stream is the Jones Creek located the nearest to Cheshire. The creek was described during 1984 in T16S, R5W, Sec 18, N1/2, where the stream was all pool and beaver ponds. The water was turbid in February when the observation was made. The stream was partly shaded with brush, hardwoods, and second growth conifers.

Farther downstream adjacent to Hall Road, Jones Creek appeared to be a ditch. Brush was along the stream near a pasture.

Jones Creek was again observed in Section 18 N1/2 in 1999, where the stream contains beaver pond and pool areas with silt in the channel. A bog is adjacent to the stream. Aquatic plants, brush, hardwoods, and second growth conifers are nearby. Sculpin were netted at this location. Farther downstream near Hall Road, the stream still is in an apparent ditch. Turbid water with silt, sand, and low to moderate wood debris were recorded. Brush, hardwoods, and various size conifers are in the riparian area. Cutthroat trout use this stream as discussed by a resident in the vicinity. Cutthroat also were found in 1999 by netting at a tributary to Jones Creek.

Bear Creek

Bear Creek was observed during 1984 in T16S, R6W, Sec 14, NE 1/4, where the stream was essentially all pool, including a beaver pond. The water was turbid and silt was high on the stream bottom where visible in February. Brush and hardwoods were in the riparian area.

Farther downstream Bear Creek was described about 0.4 mile upstream from Highway 36. The stream at this location contained primarily pool habitat with high silt loads. Hardwoods, brush, and conifers were in the riparian area. Near Highway 36 there was an estimated 40 percent pool, which contained high silt. Hardwoods, brush, and fields were nearby.

Bear Creek was observed again in 1999 within T16S, R6W, Sec.14, NE1/4. Beaver ponds and marsh areas with silt, high wood debris, and low to moderate numbers of logs were present. Riparian vegetation includes aquatic plants, brush, hardwoods, and some second growth conifers. Trout and sculpin use Upper Bear Creek drainage, as determined by netting at a small tributary.

Bear Creek contains pools and little riffle below County Road 3635 just north of Hall Road. Sand, silt, and low amounts of gravel are within the channel. There are high amounts of wood debris and moderate numbers of logs. Banks are partly eroded, and water was turbid when seen in May 1999. Riparian vegetation contains brush and hardwoods.

Long, high falls are located on Bear Creek just below Highway 36. No upstream fish passage is possible at this bedrock slide area.

In T16S, R5W, Sec 19, Bear Creek habitat near Sharewater Road includes pools, glides, riffles, and a beaver pond. The channel contains silt, sand, gravel, rubble, and cobble. Low to moderate logs and high concentrations of wood debris are available. Brush and hardwoods are within the riparian area. Trout and sculpin were found when netting in this part of the stream during 1999.

Lower Bear Creek near Hall Road west of Cheshire contains pool habitat with silt and sand. Low wood debris is present where observed. Brush, hardwoods, and fields are adjacent to the stream. Sculpin were netted at this location in 1999.

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Jones Creek

This Jones Creek enters the Long Tom River near an Oregon State Park. In 1978 the main Jones Creek Tributary in T16S, R6W, Sec 9, S1/2 was surveyed on BLM land from the lower edge of the section up to the first fork. Records included 60 percent pool, 25 percent gravel, high silt, and log piles. Vegetation included conifer timber and hardwoods. Beaver dams were observed downstream from the above location. Trout also were observed in the stream. This same tributary was inventoried approximately in 1986 downstream from Road No. 16-6-9 in the south half of section 9. Habitat types included pools, glides, and riffles. Silt, gravel, and low amounts of rubble and bedrock were in the channel. Logs were scattered along parts of the stream. Beaver dams and marsh areas also were present. Vegetation included conifers adjacent to the stream.

Jones Creek was observed during 1999 in T16S, R6W, Sec 22 where there are beaver ponds, marsh, pools, and little riffle. Silt, sand, and low gravel are available. Moderate amounts of wood debris and logs are present. Aquatic plants, brush, hardwoods, and second growth conifers are in the riparian area.

A private pond is located farther downstream in the drainage. Riparian vegetation along lower Jones Creek includes brush, hardwoods, second growth conifers, and fields.

Above the bridge upstream from the Oregon State Park, Jones Creek has pools, riffle, sand, silt, and low gravel. Moderate accumulations of wood debris and logs are in the channel. Vegetation includes brush, hardwoods, and second growth conifers. Large conifers also are at the park. Cutthroat trout were netted in 1999 near the lower end of this stream.

The main tributary to Jones Creek was described during 1999 on BLM lands in T16S, R6W, Sec 9, S1/2 below Road No. 16-6-9. The culvert at this road has a drop at the outfall. The stream contains riffles and pools with silt, sand, gravel, and cobble. A high amount of wood debris and moderate numbers of small logs and larger wood are in the channel. Hardwoods, brush, and various size conifers are adjacent to the stream. Cutthroat trout and sculpin were netted upstream from this location.

Poodle Creek

The Bureau of Fisheries surveyed Poodle Creek in 1938. The stream bottom contained rubble, clay, and sand. Dense deciduous vegetation was along this stream, and second growth trees, brush, and pasture were in the drainage. Poodle Creek was not known to be used by salmon.

Poodle Creek was surveyed by BLM during 1973 along 2.25 miles of stream within T17S, R7W, Sec 2 and 11. About 0.8 mile of the survey was on BLM land in section 11. Records included 3,580 sq. yds. of good gravel and 1,302 sq. yds. of marginal gravel. Pool areas were 8,025 sq. yds. along 80 percent of the stream. Hardwoods, brush, and old growth conifers provided 60 percent shade for the stream. Many beaver dams were recorded, and there was a high amount of silt. A reservoir also was formed by a dam that had been installed at about 1.2 miles. Cutthroat trout were estimated at 6-50 fish per 100 ft. of stream.

Farther downstream in T17S, R6W, Sec 30, Poodle Creek also was surveyed during 1973 along 1.25 miles of stream. Gravel was recorded as 1020 sq. yds. of marginal gravel for spawning. There were 8920 sq. yds. of pool along 90 percent of the stream. Stream area shaded was 60 percent. Hardwoods and brush were in the riparian area. Numerous logs, wood debris, and high silt were recorded near the upper end of this survey. Cutthroat trout were estimated at 6-50 fish per 100 ft. of stream.

Poodle Creek contained mainly pool habitat with much bedrock, a moderate amount of silt, and low gravel near the highway as recorded in 1975. Hardwoods were located along the stream.

Upper Poodle Creek was briefly observed in 1999 in T17S, R7W, Sec 2, SW1/4 where the stream contains riffles, glides, gravel, and rubble. Brush, hardwoods, conifers, and fields are adjacent to the stream, and a clear cut is located nearby.

Poodle Creek has been channelized and banks are eroded farther down near County Road 4348 north of Price Road. The pool habitat contains silt, sand, and a moderate amount of wood debris. Boulders apparently had been installed in the channel. Sculpin and dace were found in 1999 when netting at this location. Hardwoods, brush, and fields are in and near the riparian area. Vegetation was observed in a few areas farther upstream and also downstream, where there are hardwoods, brush, second growth conifers, and fields.

Downstream near Highway 126 and the road into Noti, Poodle Creek has pools, glides, riffle, sand, silt, rubble, gravel, and cobble. Boulders include apparent riprap near the road, and part of the stream banks are eroded. Low to moderate amounts of logs and wood debris are in the channel. Brush and hardwoods partly shade the stream. Cutthroat trout, sculpin, dace, and shiner were netted in this stream near the mouth of Elk Creek during 1999.

Hayes Creek

Hayes Creek was observed during 1969 in T16S, R7W, Sec 25 or 26, where part of the stream was mostly covered with logs and wood debris. A large amount of silt had been deposited farther downstream.

Upper Hayes Creek habitat was described during 1998 in T16S, R7W, Sec 26 on BLM land. Habitat was primarily rapids with few pools, and the stream gradient was moderate to steep. Channel substrates were gravel, rubble, sand, and cobble. Moderate to high concentrations of logs and wood debris were present. Hardwoods and small to large conifers were within the riparian area. Cutthroat trout were found when netting in the upper part of the drainage.

Hayes Creek contains riffles, rapids, pools, and glides near and upstream from Road No. 16-7-25 in section 25 on BLM land, as recorded in 1998 and 1999. Gravel, sand, rubble, cobble, and silt are in the channel. There are low to moderate amounts of logs and wood debris. Brush, hardwoods, and second growth conifers are in the riparian area. Trout have been found by netting in this location. The culvert has a drop at the outfall, and the gradient is steep for upstream fish passage.

Observations were made in 1999 of Hayes Creek riparian areas farther downstream, where hardwoods, brush, and second growth conifers are along the stream adjacent to clear cuts. Hardwoods also are in the riparian area below these clear cuts. Hardwoods, brush, second growth conifers, and fields are located along lower Hayes Creek near County Road 4348.

Hays Creek

This stream was previously named Jack Hays Creek on earlier maps. Hays Creek was surveyed in 1973 on 0.75 mile of stream in T17S, R7W, Sec 2 and 3. The upper part of the survey was on BLM land along approximately 0.24 mile of stream in section 3. Records included 7628 sq. yds. of good gravel and 1492 sq. yds. of marginal gravel. About 5 percent of the stream contained pools, and most of the streambed was dry. The lower 50 yds. of stream was in a reservoir formed by a dam that had been installed. Stream shade was 20 percent. Stream side vegetation included hardwoods, brush, second growth conifers, and areas that were logged several years earlier. Cutthroat trout were estimated at 0-5 fish per 100 ft. of stream.

The upper part of the south fork of Hays Creek was observed in 1998 on and adjacent to BLM near the south boundary of T17S, R7W, Sec. 3. Riffles and pools contained rubble, gravel, sand and cobble. Moderate amounts of logs and wood debris were in the channel. Hardwoods, brush and second growth conifers were in the riparian area. Cutthroat trout and sculpin were netted in this stream.

Hays Creek was observed in 1999 farther downstream on BLM in section 3, SE1/4, where the stream contains pools, riffles, and a glide. Gravel, sand, rubble, silt, and cobble are in the channel. There are low to moderate accumulations of logs and wood debris. Brush, hardwoods, and conifers are in the riparian area.

January Creek

Upper January Creek was observed on BLM land in T17S, R7W, Sec 9, SE1/4 during 1992. Trout were found when netting in this stream. Habitat types included riffles and glides, and substrates were gravel, rubble, silt, sand, and cobble. Wood debris and logs were available in the channel. Brush, hardwoods and some conifers were in the riparian area.

No recent observations by BLM have been made for fisheries at January Creek

Elk Creek

Elk Creek was surveyed in 1938 by the Bureau of Fisheries. The stream bottom contained mud and sand. No natural obstructions were found. A mill dam with a poor fish ladder was 1.2 miles above Poodle Creek. There was a slight amount of pollution from sawdust and ashes below the mill. Moderately dense vegetation was along the stream. The drainage contained mostly conifer

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trees. Upper Elk Creek habitat was described in 1999 on BLM land within T17S, R7W, Sec 27, SW1/4. Pools and riffles are available where the stream has eroded banks, high silt, sand, and low gravel. High concentrations of logs and wood debris are in the channel. Riparian vegetation includes brush, hardwoods, and second growth conifers. Cutthroat trout and sculpin are present in upper Elk Creek.

Hardwoods, brush, and second growth conifers are located downstream, where fields are adjacent to the riparian area. Farther down, below Swanson Pond, riparian vegetation includes hardwoods, brush, and a few second growth and relatively large conifers. Elk Creek at this location contains riffles, rapids, and pools, with boulders, cobble, rubble, gravel, sand, and silt in the channel. Small amounts of logs and wood debris are scattered along the stream. Shiner and sculpin were found when netting Elk Creek during 1999 in this vicinity.

Lower Elk Creek has pools and riffles with substrates of sand, rubble, gravel, and cobble in T17S, R6W, Sec 30, NE1/4. Moderate wood debris is present at this location. Brush and hardwoods are in the riparian area, and fields are located nearby. Shiner and sculpin were found in 1999 near the lower end of this stream.

Porter Creek

No information on past conditions was obtained for Porter Creek. This stream was observed during 1999 on BLM land in T17S, R7W, Sec 21, E½. Habitat types include riffles, pools, glides, cascade, and rapid areas. Substrates contain high silt, sand, gravel, rubble, cobble, and bedrock. Stream banks are partly eroded. There are high concentrations of wood debris and logs (including some log jams). Brush, hardwoods, and second growth conifers are in the riparian area. Cutthroat trout were found by netting, and sculpin also were netted near the east boundary of the section.

Lower Porter Creek riparian vegetation contains hardwoods in Section 22, SW1/4. Clear cut areas are on the adjacent hillsides.

Swamp Creek

Swamp Creek was described on BLM land during 1983 in T17S, R7W, Sec 23, NW 1/4, where the stream had a narrow flow within a marsh. Silt and mud were in the channel. Below this there were beaver dams and ponds that contained very high silt. Scattered logs and other wood were just below the ponds. Vegetation included brush, hardwoods, conifers, and snags.

Swamp Creek on BLM above Road No. 17-7-22.5 contains pools, glides, and riffles, as recorded in 1999. Sand, silt, gravel, and high amounts of logs and wood debris are in the channel. Riparian vegetation includes second growth conifers, brush, and hardwoods. There is a drop at the outfall of the culvert into a pool below. Trout were netted upstream from the road crossing.

Downstream east of Road No. 17-7-22.1 on BLM land, Swamp Creek flows through a bog area with high amounts of logs and wood debris. Silt, sand, rubble, cobble, and gravel are in the channel. Brush, hardwoods, second growth conifers, relatively large conifers, and large snags are adjacent to the stream. Small second growth conifers are within a past clear cut located above the riparian area.

Brush and fields are along Swamp Creek farther downstream near Highway 126.

Cedar Creek

This Cedar Creek is a tributary to Elk Creek. Cedar Creek habitat types are pools, glides, and riffles above Road No. 17-7-27.3. This road has a culvert with a drop into a pool below. Trout and sculpin were found in 1999 above the culvert. Sand, silt, gravel, rubble, and cobble are in the streambed. There are moderate numbers of logs and high concentrations of wood debris including slash.

Brush, hardwoods, small conifers, a few large conifers, and snags are adjacent to the stream. Second growth conifers are on BLM land farther downstream and also farther up in the drainage.

Near Highway 126, Cedar Creek has pools, a glide, and riffles containing silt, sand, and gravel. Low amounts of wood are present. Part of the stream banks are eroded. Hardwoods, brush, second growth conifers, and pasture are in the riparian area.

Noti Creek

Pond and marsh areas are located in the upper part of Noti Creek drainage, including at the logging pond near Vaughn. Riparian vegetation contains brush, aquatic plants, hardwoods, snags, and second growth conifers. Clear cut areas are upslope from the riparian vegetation.

Noti Creek below Vaughn contains pools with sand and silt. Streambanks are partly eroded. There are moderate to high concentrations of logs and wood debris in the channel. Riparian vegetation includes hardwoods, brush, some second growth and relatively large conifers. Fields and a past clear cut with small conifers are near the riparian area.

Noti Creek south of Noti has pools and riffles with rubble, cobble, gravel, bedrock, and boulders. Low amounts of logs and wood debris are available. Hardwoods, brush, second growth, and large conifers are in the riparian area. Cutthroat trout, shiner, and sculpin were found during 1999 when netting in Noti Creek.

Hardy Creek

Hardy Creek was observed on BLM lands during 1991 in T18S, R6W, Sec 17, NE1/4, where it was used by trout and sculpin. The stream contained riffles, glides, and pools with substrates of gravel, rubble, and sand. Wood debris and logs also were in the channel. Riparian vegetation included hardwoods, brush, and conifers. Farther downstream in this section, Hardy Creek contained glides, pools, and riffles with silt and gravel. Much grass was in the riparian area where there may have been a pond in the past.

On BLM land in T18S, R6W, Sec 17, Hardy Creek has pools and riffles with gravel, sand, silt, and rubble where observed in 1999. Low amounts of logs and wood debris are present. Brush and second growth conifers are in the riparian area. There is no fish passage problem at the Road No. 18-6-17 culvert, where gravel covers the bottom of the culvert. Trout and sculpin were found above the road.

Hardy Creek has pools and riffles with sand, silt, and gravel on BLM land near the north boundary of section 17. Moderate accumulations of logs and wood debris are in the channel. There may have been a pond in this location in the past. Ground cover, hardwoods, brush, and second growth conifers are in the riparian area. Brook lamprey were observed on spawning gravel areas in 1999.

Downstream on Road No. 18-6-8.5, the next crossing over Hardy Creek has two culverts at different elevations. The water from a pool below backs up into the lower culvert. There is a small beaver dam at the upper end of this culvert, forming a pond upstream. Silt and sand are in the pond. Riparian vegetation includes aquatic plants, brush, hardwoods, and second growth conifers.

A small pond in lower Hardy Creek backs up water into a road culvert located upstream. The pond is formed by a rock dam that is likely a temporary structure. Cobble, boulders, and rubble are in the stream that also has riffles and pools below the pond. Riparian vegetation consists of brush, hardwoods, and second growth conifers.

Cedar Creek

(Noti Creek tributary) - This Cedar Creek was observed in T18S, R6W, Sec 22, where pool and riffle habitats contain sand, gravel, and silt. Low to moderate logs and wood debris are in the channel. Hardwoods, brush, and small numbers of second growth conifers are along the stream. Trout and sculpin were found during netting in 1999.

Farther down Cedar Creek in section 22, the culvert at Road No. 18-6-16.3 appears passable with no drop at the outfall. Pool habitat above the road contains silt and moderate numbers of logs. This apparently was a pond area in the past. Riparian vegetation includes ground cover, hardwoods, brush, and second growth conifers.

Downstream from the above road, brush and hardwoods are along the stream and a clear cut is located above the riparian area. Farther downstream hardwoods and some second growth conifers are in the riparian vicinity.

Coyote Creek

Coyote Creek was observed at intervals by the Bureau of Fisheries in 1938. The flow was slow with no riffles where observed. The stream had a mud bottom and the water was muddy. Second growth conifers and deciduous trees thinly covered the watershed. Cutthroat trout, sculpin, and western brook lamprey were found in T19S, R5W, Sec 4 at a tributary within Coyote Creek

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drainage during electro-shocking by BLM approximately in 1995. Cutthroat and sculpin also were netted in other tributaries during 1999.

Cutthroat trout, sculpin, redside shiner, and lamprey were found during 1998 fish shocking in upper Coyote Creek. Pools, glides, and riffles were recorded where inventoried along 334 ft. of the stream on BLM land in T19S, R4W, Sec 29, NE¼. A few of the pools were caused by large wood in the channel. Riparian vegetation contained second growth conifers and hardwoods.

In upper Coyote Creek drainage an observation was made during 1999 on BLM land in T19S, R4W, Sec. 21, NE 1/4, where large conifers remain. Coyote Creek on BLM land within T19S, R4W, Sec 29 has a riparian area with hardwoods, brush, and second growth conifers. Pools and riffles contain silt, sand, gravel, cobble, and boulders. Some of the rocks appear to be from a road bank where riprap had been added. Moderate accumulations of logs and wood debris are in the channel. Part of the stream banks have eroded.

Farther downstream south of Gillespie Corners, Coyote Creek appears to be channelized. Pools, riffles, and a glide contain silt, sand, and gravel. The banks are eroded in some areas. Brush, hardwoods, and fields are adjacent to the stream. Low to moderate logs and wood debris are in the channel.

Coyote Creek contains mainly pool habitat and partly eroded bank near Bear Creek west of Gillespie Corners, where there also is a riffle with boulders and cobble under a bridge. Low amounts of wood debris and logs are present. The water was turbid when observed in June of 1999. Brush, hardwoods, and few second growth conifers are in the riparian area.

Farther downstream Coyote Creek has much pool, turbid water, silt, and partly eroded banks. Hardwoods, brush, few conifers, and fields are adjacent to this low gradient stream near the Crow High School.

Near Petzold Road, Coyote Creek has pools, except near the bridge where boulders and riprap have formed a riffle. Silt and sand are in the channel and the water is turbid. Low amounts of logs and wood debris are available. Hardwoods and brush are in the riparian area. Sculpin were netted in 1999 at this location. Warm water game fish and non-game fish are in the lower part of Coyote Creek near Fern Ridge Reservoir.

Similar habitat was observed farther downstream south of the reservoir, where fields also are near the riparian area. High water temperatures have been recorded in lower Coyote Creek during summer. The fecal coliform level has been excessive in this stream.

Spencer Creek

Spencer Creek begins near Spencer Butte south of Eugene and flows into Coyote Creek. A fork from the northeast was observed in 1999 adjacent to the Lorane Highway upstream from County Road 1270, where riffles and pools contain cobble, rubble, boulders, gravel, and low wood. Riprap also is on the road bank near the stream. Riparian vegetation includes brush, hardwoods, and second growth conifers. Cutthroat trout and sculpin were netted in this vicinity during 1999.

Farther downstream Spencer Creek contains pool habitat with eroded banks. The streambed has sand, silt, gravel, rubble, cobble, and boulders near a bridge at Chezem Road, located 0.7 mile east of Bailey Hill Road. Low amounts of wood are in the channel. Brush, hardwoods, second growth conifers, fields, and pasture are adjacent to the stream.

South of Bailey Hill Road, Spencer Creek has pools and riffles containing bedrock, cobble, rubble, and low wood debris. Brush and hardwoods are in the riparian area. A pool area with silt and low wood is located west of Bailey Hill Road. Gravel, cobble, and rubble also are near the bridge on County Road 4132. Hardwoods, brush, and ground cover are in the riparian area.

The lower part of the stream has pools, glides, and riffles with silt, sand, and low amounts of wood. However, more wood is high on the banks from previous flooding. Hardwoods, brush and fields are adjacent to the stream. Flows become intermittent during summer near the lower end of this stream. High water temperatures have been recorded during summer in lower Spencer Creek. Bass and sculpin were netted near County Road 4234 in 1999.

Sturtevante Creek

About 1 mile west of Crow, Sturtevante Creek has pools as recorded in 1999 near County Road 4335, although a riffle also is formed by rocks from riprap just below the road crossing. A large culvert with little or no drop at the outfall is under this road. Silt and sand are in the stream channel, where there are low amounts of wood. Hardwoods, brush, and second growth conifers are in the riparian area.

Sturtevante Creek is in a pasture farther downstream where some hardwoods, second growth, and a few relatively large conifers also are in the riparian area. Stream banks are eroded where observed. Pools are above and below a nearby road crossing, and riffle with gravel from the roadside is under the bridge. Brush, hardwoods, few second growth conifers, and a field are adjacent to the stream.

Lower Sturtevante Creek was observed southeast of Crow near County Road 3800. Pool areas are available with riffle at the bridge. Silt, sand, cobble size rocks from the roadside, and wood debris are in the channel. Brush, hardwoods, and fields are in the riparian area. Sculpin were found during netting at this location in 1999.

Battle Creek

Battle Creek was observed in 1984 on BLM near the west edge of T19S, R5W, Sec 5, NW 1/4. Habitat types included mainly riffles and pools, with substrates of high bedrock, gravel, rubble, and cobble. The pools contained about 40 percent silt on the stream bottom, and there was an estimated 2 percent wood in the channel riparian. Vegetation included conifers, hardwoods, and brush. Fish observed apparently were trout.

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On BLM in Section 5, NW¼, Battle Creek was inventoried along 686 feet of stream during 1998 where there were pools, riffles, and glides. Several of the pools were caused by large wood. Riparian vegetation consisted of brush, hardwoods, second growth, and relatively large conifers.

Battle Creek was observed in 1999 on BLM land in T19S, R5W, Sec 5 about 0.5 mile beyond the pavement up Road Nos. 18-5-31 and 19-5-5. The pools and riffles contain sand, silt, and gravel. Moderate to high concentrations of logs and wood debris are present. Stream banks are partly eroded. A pool below the road backs up water through the culvert. Cutthroat and sculpin were netted above the road. Brush, hardwoods, and large conifers are in the riparian area. A past clear cut is located above the riparian vegetation.

Battle Creek pools and glides contain sand, silt, and gravel farther downstream approximately 0.25 mile. Low to moderate wood debris and logs are in the stream channel. The riparian area contains brush, hardwoods, second growth conifers, and relatively large conifers.

About 0.8 mile up the road along Battle Creek from County Road 3800, this stream contains pools, riffles, sand, silt, and cobble. The riffles and cobble are adjacent to the road. Moderate to high concentrations of logs and wood debris are present. Hardwoods, brush, and second growth conifers are in the riparian area. Grass fields also are near the riparian area farther downstream, where there are few conifers.

Bear Creek

(Coyote Creek tributary) - Bear Creek habitat was described during 1974 on BLM land in T19S, R5W, Sec 21, S½, where rubble, gravel, and moderate to high silt deposits were present. Log jams and log piles were in the channel. Vegetation included hardwoods and conifers. Fish also were observed in Bear Creek drainage.

In T19S, R5W, Sec 21, S½, Bear Creek contained pools, riffles, glides, cascades, and a rapid where inventoried in 1998 along 284 feet of stream. Part of the pools were caused by large wood. Hardwoods, second growth, and relatively large conifers were in the riparian area.

On BLM land in section 21, S1/2, Bear Creek was observed in 1999. Habitat includes pools, riffles, and glides, with substrates of silt, sand, bedrock, and gravel. Low to high amounts of logs and wood debris are in the channel. A log pile is located just upstream from a long bedrock riffle. Hardwood and brush are along the stream, and second growth conifers are mainly above the riparian area. Cutthroat trout and sculpin were found by netting and observations.

Farther downstream on BLM land in section 21, at side Road No. 19-5-21.2, there are two culverts with little drop at the outfall. Habitat above this road includes riffles, pools, and rapids with rubble, gravel, sand, silt, cobble, and boulders in the channel. There are low to moderate amounts of logs and wood debris. Hardwoods, brush, second growth, and large conifers are in the riparian area. Downstream at Road No. 19-5-22.1 in section 22, another culvert has a drop at the outfall into a pool below.

Bear Creek farther downstream has riffles, pools, cobble, boulders, and rubble about 1.4 miles up the road along Bear Creek from County Road 3800. Low amounts of wood debris are present. Hardwoods, brush, second growth conifers, and a field are adjacent to the stream. Pool habitat near the mouth of Bear Creek contains silt and sand. Moderate numbers of logs and high concentrations of wood debris are present. Stream banks are eroded where observed. Brush, hardwoods, and fields are in and near the riparian area.

Amazon Creek

Amazon Creek drainage changes from cascading areas in the headwaters near Spencer Butte south of Eugene to a slow moving stream flowing west along a diversion canal to Fern Ridge Lake and also north along Amazon Creek to the Long Tom River. The upper drainage area is forested and vegetation is low to abundant along the stream flowing through residential areas in south Eugene. Amazon Creek was historically shallow and meandering with occasionally shifting channels. However, winter runoff flooded the south part of Eugene until the stream was deepened and straightened with sections of concrete channel added by the Corps of Engineers in the 1950s. West of Jefferson Street Amazon Creek again flows west past the fairgrounds.

Riparian habitat improvements and wetlands restoration were conducted during the 1990s at the West Eugene Wetlands area. In 1999 the U.S. Army Corps of Engineers relocated levees along Amazon Creek diversion canal at the Lower Amazon Restoration Area. The channel was widened to restore the connection between the flow and flood plain to improve wetlands and wildlife habitat.

Water quality has been adversely affected for fisheries by pollution from housing developments and storm runoff along Amazon Creek. Records indicate that the fecal coliform level also has been excessive. High summer water temperatures were recorded in the lower part of Amazon Creek. Riparian vegetation provides limited shade where ground cover, brush, and small hardwoods grow along some reaches. Channel structure is low although some boulders and riprap are present. Amazon Creek provides habitat for warm water game fish and other species, as indicated under characterization for this analysis.

Other Tributaries

A few additional named streams and various other tributaries provide fish habitat in the Long Tom Watershed. These streams are shown on BLM maps. Many Order 2 and larger streams provide spawning and rearing habitat for cutthroat trout. Distribution of fish species may be estimated based on stream size, gradient, confinement, field observations, and maps. Cutthroat use various streams except where gradients become too steep and where falls and cascades may obstruct fish passage. Some log jams and road culverts also are obstructions during high flows, and others interfere with passage, particularly at low flows. Culvert information concerning fish passage conditions at parts of the Long Tom Watershed was recorded, and specific information is available in BLM field notes. Further observations of culverts are needed relative to fish passage, gradients, and the drop at the outfall. Some culverts where improvements may be needed are listed under fish habitat opportunities in this analysis.

Small stream habitat types may typically include riffles, relatively small pools and glides, with also rapids and cascades in the steeper areas. Substrates are variable depending on gradients, slope stability, soils, available rock, amounts of wood, weather, flow conditions, and management activities. Fisheries and habitat conditions have become poorer on many streams because of land management activities. Higher amounts of erosion and stream siltation have resulted in locations where there have been logging, road construction, and agricultural activities.

Slash burning after logging in the past particularly resulted in erosion and siltation at draws and small streams upstream from where vegetative buffers were left for protection of fish habitat and water quality. Burning has more recently been done at slash piles located away from streams. Yarding through draws during winter rains was another cause of erosion and additional stream sediment.

Reduction of stream shade and increases in water temperatures have resulted from logging near streams, although returning brush and other vegetation soon provided sufficient shade along small streams. Large trees are no longer available in most locations for future entry into the streams. However, vegetative buffers have been left on streams with fish habitat during logging on BLM lands, and much more protection recently is being included for small streams at timber sale areas.

Wood may remain in small streams from past old growth conifers, more recent second growth, hardwoods, and old slash. Wood retention is often better on the smaller streams because of relatively low flow conditions. Small logs and wood debris also may provide much of the structure and cover in these streams.

Data Gaps

Most information under past and present conditions was based on brief observations by BLM at scattered locations throughout parts of the Long Tom Watershed. More detailed fisheries and habitat information is needed throughout much of the watershed. Such needs include more fish distribution information, fish population studies, and habitat inventories.

More field information is needed at road culverts and irrigation dams to determine fish passage conditions. Project planning information and associated mapping would be necessary for future fish habitat development projects. Monitoring also would be helpful for determining effects of these projects on fish habitat. Field observations would need to be continued for fisheries and riparian management at future timber sales and other land management activities. Studies concerning wood in streams and effects of riparian modifications on fish habitat would be of value for future stream and riparian management.

Water quality and soils information on temperatures, sediment, siltation, erosion, and slope stability would continue to be useful relative to fisheries management. More information on invertebrates and other aquatic animals also would be of value for fisheries management. Additional review of fisheries, water quality, and habitat information would be useful for determination of future fisheries management within the watershed. It would particularly be of value to continue reviewing information from ODFW and the Long Tom Watershed Council. Visitation data is needed reflecting number of visits and recreational pursuits.

RECREATION

Past and current recreational uses on BLM lands have been dispersed uses such as target shooting, driving for pleasure, camping, hunting, OHV, watching wildlife, and hiking. Developed facilities outside of the Triangle Lake maintenance shop location are limited to those within the BLM Wetland area in the city of Eugene (see Wetland section). Because BLM lands are on the valley fringe to the Eugene/Springfield/Junction City urban centers, the number of recreationists increases on BLM lands in conjunction with urban population growth. Unfortunately, BLM does not have any accurate data on the number of visits for any of the dispersed activities or know all the dispersed uses occurring.

Dispersed OHV activity has been traditionally concentrated in an area known as Low Pass for many years. This is an area of about 5,500 acres of BLM and private land ownership within the watershed boundary. It has been difficult for BLM to establish a designated riding area here due to the checkerboard ownership. In 1994 BLM tried to coordinate with 2 neighboring landowners as well as a motorcycle club to designate a trail riding system and develop staging areas. For various reasons this effort has not been accomplished to date.

Young adults looking for out-of-the-way places for parties have used BLM lands for this purpose. Usually these parties have gone on unnoticed unless there is a disastrous outcome, such as a shooting death, which happened near Hadleyville a few years ago. BLM has since gated the road where these particular parties were occurring. The State has given BLM a map of party areas where campfires have escaped control.

WETLANDS - The BLM/Eugene Wetland area is currently used for outdoor education activities, botany research studies, and recreational activities such as hiking and watching wildlife. A few trails, Watchable Wildlife sites, and a photo blind have been developed within the Wetlands during the past 5 years. Partnership in this wetland includes the City of Eugene, BLM, The Nature Conservancy, Corps of Engineers, and Oregon Youth Conservation Core (OYCC). Up to this time, none of the partners have set up any accounting system to collect visitor data on recreational activities or visits. This is a data gap that could help future planning needs.

Being located within the city has attracted additional human use problems such as garbage dumping, trespassing, homeless campsites, and some recreational activities not in keeping with the Wetland philosophy such as BMX bicycle jumps and target shooting. Law enforcement has been employed several times to keep things in check, and volunteer groups have also helped in clean ups.

ROAD ACCESS ISSUES - There are 1,419 miles of road within the watershed. The breakdown of road miles is rounded to:

Private roads	1,164 miles
State of Oregon roads	44 miles
Lane County roads	66 miles
BLM - administrative roads	145 miles
Total	1,419 miles

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This information from GIS is currently being updated, and these mileages may change upon completion of this project in 2003.

The public has been and is used to driving on most of the roads for recreational use. Although many of these roads may be physically open to the public, some BLM roads may be closed to public access at any time due to the type of easement or agreement that BLM has.

BLM obtains one of 4 types of road easements/agreements from adjacent landowners in order to obtain access to BLM lands. These easements/agreements are briefly described below as they may set conditions of public access rights.

> **Exclusive Easement** - A grant to BLM from a private landowner giving BLM control of a road over the owners private land and usually (but not always) including legal access for the public. (BLM Public)
>
> **Nonexclusive Easement** - A grant to BLM from a private landowner giving BLM the right to use a private road over the owner's land for administrative access to BLM land. These easements do not include rights for the public to use the road (again with rare exceptions). The public can use these roads with the permission of the private landowner, but they may be closed to public use at any time. (BLM Administrative)
>
> **Reciprocal Road Right-of-way Agreement** - A legal agreement between BLM and a private landowner providing rights for each party to use and construct roads over specifically identified lands of the other party. These agreements include provisions to determine which party controls individual roads and road segments and usually include provisions to establish road use and maintenance fees to be paid to the party controlling a road when it is used by the other party for the commercial transportation of forest products. The rights granted by the private landowner do not include legal access for the public over the private lands. (BLM Reciprocal Agreement)
>
> **BLM/State of Oregon Cooperative Road Use Agreement** - An agreement between BLM and the Oregon Department of Forestry providing rights for each party to use and construct roads over lands of the other party for purposes of land management. Since the lands involved are all in public ownership, use by the public is generally authorized.

OHV use for this watershed area is listed in the RMP as "limited to existing roads and trails", unless a road has been listed as closed, seasonally closed, or open. The Long Tom Watershed has the following roads (or portions of) listed as seasonally closed during certain times of the year to enhance and/or protect resources (refer to map for location and length of segment).

> **South Valley Resource Area** - Road seasonally closed from 4/1 to 10/31 for critical resources: 19-5-15 (0.6 mi)
>
> > "Critical resources" includes T&E wildlife and plant species, fish spawning and habitat areas, and wildlife such as elk emphasis areas.

The following roads, totaling 3.45 miles, are listed as seasonally closed from 12/1 to 9/30 for critical resources, public safety, and resource damage:

19-4-9 (0.14 mi)   19-4-9.1 (0.4 mi)   19-4-9.2 (0.13 mi)
19-4-17 (0.14 mi)   19-4-4 (2.64 mi)

Coast Range Resource Area - Roads seasonally closed from 3/1 to 9/30 for critical resources are:

15-6-33.5 (0.9 mi)   17-7-1 (3.2 mi)   17-6-30.1 (1.12 mi)
15-6-33.6 (0.4 mi)   17-7-15 (0.5 mi)

Roads seasonally closed from 1/1 to 8/31 for critical resources are:

17-6-4 (0.54 mi)   16-6-33.1 (0.38 mi)   16-6-33.2 (.05 mi)
16-6-33.3 (0.18 mi)   16-6-33.4 (0.08 mi)

Area closed for critical resources is: Long Tom ACEC - 7 acres

Areas limited to designated roads due to botany T&E plant concerns are:

Area within T. 16, R. 6 W., Sec. 35   limited to Road No. 16-6-2.1 (0.29 mi)
Area within T. 16, R. 6 W., Sec. 1   limited to Road No. 16-6-1 (0.5 mi)
Area within T. 16, R. 6 W., Sec. 12   limited to Road No. 16-5-7 (0.26 mi)

During this watershed analysis these roads were found to be either under reciprocal rights-of-way agreements or have nonexclusive agreements with other partners. In other words, public access is not secured.

BLM has the authority to enforce public restrictions such as closures on the road segments that are on BLM land while still allowing use by the other partners named in the easement (there are some rare exceptions). The Code of Federal Regulations (CFR) states among other things, that, "any vehicle whose use is expressly authorized by the authorized officer" may use the road (CFR 8340.0-5(a)(3)). This gives BLM's easement partner access to the road if needed while restricting access to the public.

The RMP does state that ". . . there could be necessary modifications within these designations based upon watershed analysis . . ." (p. 207 of the ROD).

VISUAL RESOURCE MANAGEMENT

The majority of the Long Tom Watershed on BLM administered lands is managed as VRM IV. Class IV allows for major modifications of the existing character of the landscape. There are 13 Rural Interface Areas (RIA) present within the watershed meeting the RMP ROD standards to manage as VRM Class III (see the Rural Interface Area section below). Class III partially retains the existing character of the landscape. There are also small portions of 2 Special Recreation Management Areas (SRMAs) which are also managed as VRM Class III. The watershed is not managed for VRM Classes I and II. The current acres of VRM management classes are:

VRM I - none

VRM II - none

VRM III - 400 acres of RIA
270 acres of the Upper Lake Creek SRMA
9 acres of the Lower Lake Creek SRMA
679 total VRM III management acres

VRM IV- rest of the watershed acres = 262,070

RURAL INTERFACE AREA

The ROD/RMP states that BLM administered land within ¼ mile of private lands zoned for 1-5 acres or 5-20 acre lots would be managed for VRM III as well as other treatments (page 79 of the ROD). During the RMP process, the BLM GIS system identified 13 land parcels with this criteria within the Long Tom Watershed process for a total of 400 acres (see the Long Tom Landscape Analysis Unit Map).

WILDLIFE

Wildlife abundance, distribution, and species composition are components of the natural environment that often fluctuate dramatically through time. Biotic and abiotic factors influence these fluctuations. The present conditions of vegetation and topography in the Valley Fringe of the Long Tom Watershed bear little resemblance to the past conditions. It is not surprising that the composition of the wildlife component has changed a great deal as well.

Prior to European settlement, the Valley Fringe was composed of large interconnected blocks of mature and older conifer trees. Frequent small scale disturbance combined with infrequent large scale disturbance to create large patches of complex forest habitats with blended edges that provided for a variety of wildlife that exploited interior forest habitats. Following European settlement, land management practices and land ownership patterns created smaller patches of dissimilar vegetation structure with sharply contrasting edges between adjacent habitats. The fragmentation, introduction of exotic species, and alteration in vegetation distribution resulted in changes in wildlife species composition, favoring edge species, early to mid-seral species, and habitat generalists while reducing opportunity for late-succession dependent species. Habitat structures and their associated wildlife species are discussed in greater detail below.

MATURE FOREST HABITAT AND ASSOCIATED SPECIES - Late-Successional forest is described as forest seral stages that contain the mature and old growth age classes (USDA and USDI, 1994). The mature age class for conifers in western Oregon is generally defined as 80-200 years old (FEMAT 1993); USDA and USDI, 1994). "Old growth" stands are those older than 200 years. Old growth forests generally exhibit high structural heterogeneity in the form of multi-storied canopies, a wide range of tree diameters and heights including tall large trees, and abundant snags and down logs (Franklin and Spies, 1991). Wildlife species associated with late-successional temperate coniferous forest are listed in Lehmkuhl and Ruggierro (1991).

SNAGS - This important structural component of forest communities provides habitat for a wide array of wildlife species. Mature and older trees convert to the most valuable snags. Many species of invertebrates, reptiles, amphibians, birds, and mammals use larger diameter standing dead wood as foraging and breeding habitat.

Past condition: As previously described, most of the Valley Fringe coniferous forest was in a mature to late-successional stage. Disturbances like fire, disease, and wind plus plain old age intermittently created snags in a variety of ages, diameters, and patch sizes across the area.

Present condition: Currently within the Valley Fringe there are a few sites with adequate numbers of snags; however, snag levels are deficient over most of the landscape. The last century's land management practices (logging, firewood cutting, road and trail construction, and safety) actively removed snags from the landscape. In addition, conifer stand structure was reduced to younger stages where there is little opportunity for snag recruitment. Recently, the designation of 7,847 acres of BLM lands within this watershed as LSR will allow the forests on these sites to mature enough for mortality factors to start creating snags. In addition, the Eugene Resource Management Plan (RMP) requires the District to allow enough snags and green trees (for future snags) 15 inches dbh or greater to be retained at levels sufficient to support cavity dependent species at 40 percent of the potential population levels.

COARSE WOODY DEBRIS - Coarse woody debris (CWD), like snags, is an important component of forested systems. Dead and down woody material such as stumps, root wads, bark, limbs, and logs in various stages of decay occur in all forest systems. Temperate coniferous forests in this area produce large amounts of woody material, and in unmanaged forests this volume eventually makes its way to the forest floor. Dead and down material has many important functions in mineral cycling, nutrient mobilization, and forest regeneration. It also creates structure and a complex habitat on the forest floor that is valuable to many terrestrial and aquatic wildlife species.

Past Condition: As previously described, most of the Valley Fringe coniferous forest was in a mature to late-successional stage. The same disturbances like fire, disease, and wind plus old age that created snags also contributed to supplying coarse woody debris to the forest floor. Sites that were susceptible to disturbance as a result of topography and aspect as well as areas downstream from them probably maintained concentrations of down wood material.

Present Condition: Currently within the forested portion of the Valley Fringe there are about 3,756 acres designated as old forest. These small patches probably contain the most CWD and may have some material in the larger size classes. Within the balance of the forested landscape, the last century's land management practices (logging, yarding cull logs, broadcast burning, firewood cutting) reduced CWD across most of the landscape. In addition, conifer stand structure was reduced to younger stages where there is little opportunity for large diameter CWD recruitment, and the CWD that is created is in the early decay classes. Recently, the designation of 7,838 acres of BLM lands within this watershed as LSR will allow the forests on these sites to mature enough for mortality factors to start creating CWD. In addition, the Eugene Resource Management Plan requires the District to leave a minimum of 240 linear feet of logs per acre greater than or equal to 20 inches in diameter during a logging operation, and merchantable material will be used to make up any deficit if other material cannot.

RIPARIAN HABITAT AND ASSOCIATED SPECIES - Riparian habitat provides special conditions necessary for, or conducive to, survival of many wildlife species. These areas provide important linkage habitat, moist soil environments, and unique structural components not found in the upland environment. The Valley Fringe riparian habitat and conditions differ a great deal from the valley bottom. The Valley Fringe is composed of steep-side incised channels that collect runoff from the east side of the Coast Range into about 10 main tributaries of the Long Tom River. The headwater drainages are steep while the collecting tributaries are relatively gentle.

Past Condition: Historically, vegetation types and canopy closure within the riparian area varied according to stream size, channel form and slope, valley shape, and flood frequency. Typically, fire effects were greatly reduced in riparian areas leaving floods and landslides as the major disturbances. The result was a system dominated by large old conifer trees, deciduous shrub and tree stringers, and large amounts of coarse woody debris. Faster-growing deciduous trees often grew immediately adjacent to the stream depending on gradient and stream action. Steep reaches had less deciduous habitat within 200 feet of the channel than did flatter reaches. The wide flood plains, beaver ponds, and open wet meadows common in the gentler reaches increased ground water levels, creating better conditions for the more moisture tolerant hardwoods over conifers.

Present Condition: Land management activities in the last few decades have altered the species and age composition of riparian vegetation in the Valley Fringe. As a result, Riparian Reserves were established on federal lands by the ROD/RMP (1994) to place emphasis on maintaining the ecological and physical process of the areas between water bodies and uplands. Vegetation seral stages within Riparian Reserves provides a useful assessment of current riparian vegetation conditions. Riparian Reserves on federal land in the Valley Fringe consist of 9,389 acres (about 58% of the riparian corridors). About 27 percent of the Reserves are in mature conifer/conifer mix. Many areas formerly dominated by conifers have been converted to hardwood stands (14% of Riparian Reserve), young to mid seral stage conifer stands (58% of Riparian Reserves) or grass/shrub habitat (0.8% of Riparian Reserve). On private lands logging and agricultural practices have reduced conifer dominated riparian habitat to a greater degree. In addition, log drives and stream cleaning have drastically reduced the number and size of down logs within stream corridors. The majority of riparian habitat remains altered. Lastly, the removal of the influence of beaver, a keystone species, over most of the landscape has reduced the amount of lower gradient ponded water (and the associated rise and spread of the water table) effectively narrowing the riparian corridor. The ultimate results for riparian associated wildlife species is that opportunities for wildlife species associated with ponded water, swamps, and wet meadows are reduced as are opportunities for species that exploit large old riparian conifer habitats. However, species that use young deciduous and coniferous tree habitats have increased opportunities available currently.

INDIVIDUAL SPECIES OF INTEREST

There are several species of special interest residing in the Valley Fringe. These include large mammals such as elk, black-tailed deer, black bear, and mountain lion; species protected by the Endangered Species Act; species of special federal concern; species specially managed through BLM policy; and species that are of special interest to the State of Oregon.

Large Mammals

Roosevelt Elk - Roosevelt elk were abundant throughout this area until the market hunting days at the turn of the century. By the end of those years, elk herds had been reduced to small groups scattered along the coast and in the Cascade Range (ODFW 1987). Through conservation efforts during the last 80 years including reserves, restricted hunting seasons, forage enhancement, and transplants, this species made a comeback.

Elk are an edge-adapted species using open early succession forest habitat and grasslands to forage and older forest habitats for cover and protection. In the Coast Range no seasonal migration occurs due to the low elevation and lack of snow. The Valley Fringe provided excellent habitat for elk. Forage areas were readily available along the edge of the Coast Range and the Willamette Valley as well as the smaller grassy/shrubby creek bottoms dissecting the foothills. Disturbances such as stand replacement fires that periodically swept through the area were preferred forage sites as well. Elk were eradicated from this area during the population reductions at the turn of the century; however, during the past 80 years they have repopulated the Valley Fringe in relatively small numbers.

Today, the Long Tom Watershed is part of three ODFW Big Game Management Areas (BGMA) - the Willamette, Alsea, and Siuslaw. The Willamette BGMA, where about 40 percent of the Watershed is located, has been designated an Elk Emphasis Area (ODFW 1994). About 10 percent of the watershed lies in the Alsea BGMA where the elk population has been increasing since the early 1980s. As of 1994, the population estimate was 5,600 elk and ODFW (1994) has listed a population management objective of 7,000. The remaining one half of the watershed is located in the Siuslaw BGMA. Current populations in this unit are primarily due to the ODFW transplant program during the 1970s. Elk are widely scattered, and the population is relatively low (1994 estimates ~ 1,200 over 1,500 sq. mi.). The population management objective is 4,000.

The habitat matrix for elk in the **Valley Fringe** of the watershed falls mostly into the Siuslaw BGMA with the area north of Highway 36 located within the Alsea Unit. In the present day habitat composition, valley bottoms are no longer as available to elk as in the past due to human modifications. Now clear cuts are often used for foraging habitat. In the Valley Fringe the most recent clear cuts appear to be concentrated in the northern half. On BLM lands within the watershed, approximately 4,908 acres are considered foraging habitat. About 15,000 acres are designated as hiding cover, and approximately 11,000 acres qualify as thermal cover. The acres of private lands within the Valley Fringe have not been quantified in these categories but, given the typical 60-year rotation, it can be assumed that these holdings provide forage and hiding opportunities, and limited thermal cover.

Human accessibility to elk habitat, particularly during the hunting season, is one of the most influential factors on elk herd management. Hunting not only affects numbers but influences distribution and herd dynamics as well. In addition, high accessibility can cause disturbance, displacement, and mortality among elk. At present the road density on BLM lands within the watershed is approximately 4.2 miles per square mile (650 total miles of road). According to the Eugene District RMP, in elk habitat areas "A general target for roads open to motorized use is 1.5 miles or less per square mile." Figures for private road are not available; however, access is often limited to the public on privately owned land, therefore limiting the affect of the road to elk.

Black-tailed Deer - This species prefers forested areas where dense hiding cover is associated with more open foraging area. They tend to browse more than graze but are often in similar habitats to elk. Black-tailed deer are abundant throughout the Long Tom Watershed. The interspersion of foraging areas and hiding cover varies somewhat between the Valley Fringe and the rest of the watershed. The Valley Fringe has a greater proportion of cover in comparison. There is speculation (USDI 1999) that cover may be less of a limiting factor to deer populations than good quality browse and forage availability. Currently browse and forage do not appear to be limiting to the deer population within the Valley Fringe.

Black Bear - Past conditions were favorable for black bears. Being an omnivorous generalist of forested and edge habitats, this species must have been a common resident along the Valley Fringe. Current conditions have presented some challenges for the persistence of black bears; however, they are adaptable and have coped well with a changing environment. No population estimates for black bear are available for the Valley Fringe but densities for western Oregon are estimated at one bear/1.1 sq. mi. (ODFW 1993). Based on that estimate, the Valley Fringe could support up to 138 bears. This does not consider that recent timber practices have reduced potential denning habitat by removing large trees, stumps, and logs. It also does not consider the influence of human modifications in the valley bottoms, roads, and attractions (garbage, dog food) that may ultimately get the bear removed (one way or another) from the population. It is likely that the actual black bear number is something less than this estimate.

Mountain Lion - Cougar were characterized as abundant or common throughout most of the forested parts of the State up until the early 1900s (ODFW 1998). The bounty system along with human habitat alterations combined to reduce cougars to an estimated all time low in the early 1960s of 200 animals in the State and a prediction that this species would be extirpated by the early 1970s. The species was protected at that point and later was classified as a game animal.

Currently cougars are now distributed Statewide with the exception of portions of the Willamette Valley, and other interior valleys where resident deer and elk populations are small. It is likely that the Long Tom Watershed essentially falls into this category. Cougar occupancy is probably lower to much lower than the average 7.5 animals per 100 sq. mi. The Valley Fringe would be the most likely area that mountain lion would reside where it would reasonably be associated with the greatest deer and elk densities.

Threatened and Endangered Species

Within the Long Tom Watershed intensive inventories have been conducted for the northern spotted owl and bald eagle and, to a lesser degree, the marbled murrelet.

Bald Eagle (Status - threatened) - This species was probably much more abundant in the Long Tom Watershed historically than in recent years. It is associated with large water bodies - lakes, rivers, and estuaries - and feeds primarily on aquatic species such as fish and waterfowl. The use of DDT during the mid part of this century was the primary factor that reduced the continental populations of this raptor to low enough levels that protection was warranted. During the past 30 years the bald eagle has re-colonized many areas where it had been absent from for decades. Currently, over 250 nests are documented in Oregon and well over 1,000 migrants winter in the State. (Csuti et al. 1997).

The bald eagle requires large trees or cliffs for nesting. In western Oregon, nests are constructed in large dominant trees about one-quarter the length from the top. Nests are usually in line-of-sight of a major water body. Presently there is one bald eagle nest documented on BLM lands in the Valley Fringe. It is currently active and has fledged young in recent years. There are 6 BLM parcels totaling 192 acres designated as Bald Eagle Habitat Areas (BEHA) within the Valley Fringe (Map x). These are areas designated in the District RMP (1995) that contain suitable habitat for eagles and are in proximity to open water. They are managed as ". . . essential habitat to bald eagle recovery".

Northern Spotted Owl (Status - threatened) - This species probably was fairly abundant and well distributed throughout the Valley Fringe based on the amount and distribution of mature forests. Disturbances likely altered numbers and distribution spacially and temporally but over the larger scale the population persisted.

Spotted owls rely on older seral stages for nesting and foraging. These birds nest in trees large enough to provide a cavity or platform that can hold a nest and young. Douglas-fir reach this size in the Coast Range at about 80 years old. Also at this age, forested stands begin to develop snags and coarse woody debris that provide suitable habitat for the owls' prey species. Currently, the Valley Fringe supports 5 known Owl Habitat Areas totaling 503 acres and another nest site located in the Ferguson Creek drainage. In addition, there are approximately 8,380 acres of habitat suitable for this species.

Marbled Murrelet (Status - threatened) - In Oregon these birds nest in mature or old growth forests as far as 50 miles from the coast. Within the Eugene District most murrelet nesting activity occurs within 35 miles of the sea. The Valley Fringe falls within the 35-50 mile distance -

at the outer perimeter of the nesting range for this area. Therefore, it is likely that this species was probably not an abundant resident along the Valley Fringe historically even though it does fall within the 50 mile perimeter to the coast. Since 1990, the Eugene District has performed about 7 two-year surveys for murrelets. One detection was recorded for the Valley Fringe near Ferguson Creek but has not been documented again. Because the Valley Fringe is within the 50-mile perimeter potential habitat has been identified. About 5,865 acres of mature or older Douglas-fir stands exist within the watershed 28 percent of which are designated as LSRs (Thrailkill vegetation data).

Fender's Blue Butterfly (Status - Endangered) - Larvae of this species are limited to lupines and, in this area, it is using Kincaid's Lupine, *Lupinus sulphereous* var. *kincaidii* where available, and the Spurred Lupine, *Lupinus laxiflorus*, as an alternate host. Because of the conversion of native prairie to human-modified habitats in the Willamette Valley, Kincaid's Lupine is now a rare plant and is also a proposed endangered species to the Endangered Species Act.

The Fender's blue was originally limited to native prairie both in the Willamette Valley and on adjacent low hills. Currently, it is known from only 4 areas within the Eugene District. Three of these sites occur within the Long Tom watershed. The conservation of these remaining populations depends on the landowners' management. Surviving populations of Fender's blue are threatened by exotic grasses and weeds, succession to brush, and human development.

Federal Species of Concern

These are species that formerly appeared as Category 2 species to the Endangered Species Act. That designation has been dropped, and these species are now simply those where abundance, population stability, and trend are unknown.

INVERTEBRATES (information taken from Applegarth 1995)

Oregon Giant Earthworm - This species is likely to have occurred within the Long Tom Watershed and the Valley Fringe. It is known from the Coast Range and the Willamette Valley where it appears to be restricted to deep, little disturbed soils in moist forest. It is no longer found in the open valley grasslands but is found instead in the forests that intrude into or hem the valley. No individuals have been documented in the Valley Fringe.

Siskiyou Chloealtis Grasshopper - This species has not been documented within the watershed; however, it has been located just north in Benton County. It may depend on damp rotten conifer logs that are partly shaded by living trees.

Vertree's Ochrotrichian Micro-caddisfly - This species has been documented in the Umpqua River south of this watershed but has not been found within it. Larvae of this genus have been found in cold spring-fed streams and relatively warm rivers, but seem to prefer cool, clear, swift flowing streams. Some of the Valley Fringe streams match this description.

Siskiyou Caddisfly - This species has not been found in the Long Tom Watershed or the Eugene District; however, there is a reasonable possibility that it is present at intermediate elevations, along any size stream. It has been located in a few sites north and south of the District.

Roth's Blind Carabid Beetle - This species has been found on isolated sites just north of the Long Tom Watershed in Benton County. It has not been located within the watershed itself, although suitable habitat is available in the Valley Fringe. Most likely in the past this species inhabited a wide range of elevations in the Oregon Coast Range, and now has been reduced to a few relict fragments of its former distribution. It is restricted to cool, moist, closed-canopy conifer forests with well-drained, deep, coarse-crumb structured soils. This beetle lives underground and is found only in soils that developed in place not alluvial soils.

AMPHIBIANS AND REPTILES

(information from Applegarth 1994)

Tailed Frog - This species is small, less than 2 inches in length, and is adapted to high-gradient streams in the temperate rain forests of the Pacific Northwest. This species was probably widespread throughout this type of habitat in the past. Presently, watersheds with extensive logging, burning, or road building often have streambeds that are blanketed by silt, and the Tailed frog is rare or absent in those streams. Presently, Tailed frog numbers are often small and isolated and appear to be remnants of a once larger population. One location has been documented in the Valley Fringe. Four tadpoles were located in January Creek a small tributary of Poodle Creek. This location raises the likelihood that there are other small populations in the tributaries of the Valley Fringe.

Northern Red-legged Frog - This frog probably was common in the Willamette and other western valleys in prehistoric times. Records indicate that this species was much more abundant than the current condition. The reasons for this decline are not clear, but the presence of introduced fishes and the Bullfrog usually corresponds with the local absence of the Red-legged frog. Other factors may be loss of habitat and chemical pollution of habitat, especially breeding ponds. The Red-legged frog is documented at one location, Hardy Creek, within the Valley Fringe. This location raises the possibility that there are other populations within the Valley Fringe.

Foothill Yellow-legged Frog - In Oregon, this species occurs at lower elevations in streams with riffles, emergent rocks, and gravel bars. This frog was considered abundant 50 years ago. Now it is scarce in southwestern Oregon and rare in the Willamette Valley. Within the Eugene District this species has declined to a few isolated populations. They are most abundant in the absence of introduced aquatic predators. It occurs in the southwestern part of the Coast Range along the Smith River; however, there are no documented locations farther north or within the Valley Fringe.

Variegated Salamander - This species is found in the Coast Range Resource Area where it is fairly widespread but restricted to suitable habitat. It is associated with old growth

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forest in gravelly seeps and small 1st order streams. Because of its habitat preference it was likely more abundant under past conditions rather than present conditions. They are considered to be vulnerable to forest fragmentation and, while they have been occasionally located in clear cuts, their survival there is questionable. The preferred habitat seems to be well-shaded permanent streams with moss-capped rock rubble and water trickling between the rocks. This salamander has been documented within the Valley Fringe in several places along tributaries to Poodle Creek.

Western Pond Turtle - Western pond turtle numbers are declining and may be a fraction of the number present 2 centuries ago. Habitat degradation and loss are thought to be the primary factors for this decline. Human alteration of valley rivers and wetlands is the major contributor. The western pond turtle is not found in the Coast Range. It is mostly a species of the valley bottom. It is resident at the West Eugene Wetlands within the Long Tom Watershed and most likely other isolated private valley wetlands.

BIRDS

Northern Goshawk - Past conditions for goshawks are unknown in this area, but a small population of goshawks appears to reside within the Willamette Valley with much of the activity centered in Lane and Benton Counties (Csuti et al 1997). The Long Tom watershed is located within this area and is known to support goshawk activity. One nest is documented on BLM lands in the Valley Fringe and much of the watershed could be used as winter habitat.

Western Burrowing Owl - Burrowing owls were once considered common in the Rogue River Valley, but they have disappeared from the valleys of southwestern Oregon. A few spend the winter in western Oregon (Csuti et. al 1997). The valley portion of the watershed could host wintering birds.

Little Willow Flycatcher - This flycatcher frequents shrub fields and shrubby riparian habitats. Its past distribution in the watershed is unknown; however, it currently occupies many sites throughout the valley and the Valley Fringe.

Harlequin Duck - While present in numbers on the coast during the winter and found breeding on many streams in the Cascade Range during the summer, this species does not typically breed in the Coast Range. The Long Tom Watershed may host an occasional winter bird but is not preferred habitat for this species.

Western Least Bittern - This is a regionally rare species at the northern edge of its range. It has been documented mainly east of the Cascade Range (Csuti et. al 1997). Occurrence in the Long Tom Watershed would be incidental.

MAMMALS

BATS - **Long-eared myotis, Fringed myotis, Long-legged myotis, Yuma myotis, Pacific western big-eared bat** - These bat species all occur within the Coast Range and are likely residents of the Valley Fringe. All are found in Douglas-fir forests and rely heavily on snags or older trees for roosting and/or raising young. Surveys in nearby watersheds have shown that snags were the preferred day roost sites and Douglas-fir was the dominant species used. In addition, concrete bridges have become important for night roosts. Caves and rock outcrops are also important roost sites but these structures are uncommon in the watershed. Only one small cave within the Coast Range has documented bat use. These bat species feed on insects and are attracted to areas such as water bodies that support high insect densities.

White-footed Vole - Very little is known about the life history of this microtine. It is presently considered very rare and is found in riparian alder/small stream habitats or old growth conifer habitats at stream sides. They are reported from salmonberry thickets, under streambanks, or in debris piles adjacent to streams. They are almost always found within 35 meters (115 feet) of a stream (USDI 1999). Hardwood dominated riparian habitat is currently common throughout the Valley Fringe. However, late-successional conifer habitat near stream sides is limited, and the modification and fragmentation of stream side vegetation may have limited habitat suitability in many places. No surveys for white-footed voles have been conducted.

BLM SPECIAL STATUS SPECIES

Survey & Manage Species - The status of these species may be subject to change with completion of a supplemental EIS currently underway.

MOLLUSKS - These species were likely spread throughout the limits of their distribution in a patchy manner as they exploited favored "bonanza" habitats within the greater matrix. The present condition has isolated small remnant populations between large (vast to a mollusk) areas of unsuitable habitat and removed the potential linkage avenues creating disjunct insulated occurrences (Applegarth pers. comm.).

Oregon Megomphix - This snail is known from the Cascade Foothills and the Coast Range. It is most often found in hardwood leaf litter and decaying nonconiferous plant material under bigleaf maple trees. Surveys have located 20 known sites of this species in the Valley Fringe in 3 project areas. There is some speculation that down woody debris created linkages between these sites, allowing for eventual colonization of new habitat and genetic transfer between existing populations.

Evening Fieldslug - Although experts had speculated that this species might occur here, it has not been found and the experts no longer suspect its presence.

Blue-gray Tail-dropper - This widespread species is found in open to moist conifer forests at a wide range of elevations. Surveys have located this slug at 8 known sites in 4 project areas within the Valley Fringe to date.

Papillose Tail-dropper - This is a widespread species that occurs in the Coast and Cascade Ranges. It appears to be associated with hardwood trees. It has been found in sites that are similar to but somewhat more exposed than those described for the Blue-grey tail-dropper. Surveys in the Valley Fringe have documented 12 known sites where this species occurs in 3 project areas.

Red Tree Vole - Historical distribution and abundance of red tree vole in the Valley Fringe is unknown. However, based on known habitat requirements (conifer stands greater than 100 years old) much of the Valley Fringe met this criteria. Timber harvest activities of the last century have reduced the amount of suitable habitat available to red tree voles. Currently, there is one red tree vole nest documented in the Valley Fringe, and there are about 7,957 acres in 153 isolated patches that fit the habitat criteria. Red tree voles are thought to have limited dispersal capabilities, and the current level of forest patchiness may be creating dispersal barriers between the occupied islands of habitat.

Sensitive Species

American Acertropis Grass Bug - This insect seems to be associated with native prairie, particularly the wet *Deschampsia* meadows of the Willamette Valley. It has not been located within the Eugene District yet, however suitable habitat has been identified within the West Eugene Wetlands and along the Long Tom River. It is, therefore, very likely that it did occur and could still occur within this watershed.

Taylor's Checkerspot - The Taylor's checkerspot is a subspecies of Edith's checkerspot and was limited to Benton, Lane, and Polk counties where it inhabited the Willamette Valley native prairie habitats. The conversion of this habitat has reduced the availability of the host plant (*Plantago*) and the suitable plant community for this subspecies. There is a possibility that it is still surviving in association with isolated patches of low-elevation native grasslands within the watershed.

Bureau Tracking and Assessment Species

The District RMP (1995) states that active management for assessment species (BA) will be undertaken to assure survival of these species in Oregon. It further says that Bureau policy identifies tracking species (BT) as species where some management concerns are identified. Management emphasis is to record observations.

INVERTEBRATES

Foliaceous Lace Bug (BA) - In the Coast Range, this species has been recorded from Polk and Benton counties. The presence of this species was recently discovered in Oregon, which is the first record for North America. There are number of populations in Oregon, and they seem to be native. It could occur within the Valley Fringe.

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Lillianis Moss Bug (BT) - These small bugs live in relatively cold, dry, rocky ridges and boreal meadows. It is not likely to occur within the watershed.

Mulsant's Water-treader (BT) - This species has not been found in Lane County, but it has been found in Benton and Linn Counties. It inhabits floating vegetation and open water in ponds. It could occur in the watershed.

Alsea Ochrotrichian Micro-caddisfly (BT) - This species is known to occur in the Coast Range in Benton County and, therefore, could possibly occur in the Valley Fringe.

True Fir Pinalitus (BT) - This species feeds on sickly Douglas-fir and is known from scattered locations in the western United States, including eastern Lane County. It could occur in the Valley Fringe.

Douglas-fir Platylygus (BT) - This bug is associated with Douglas-fir and has been documented in eastern Lane County. It is possible that it could occur in the Valley Fringe.

Corvallis Diving Beetle (BT) - This species is known from a single specimen found near Corvallis in 1923. It may burrow into the sand along the margins of streams or ponds. It is not likely to occur in the Long Tom Watershed.

Marsh Carabid Beetle (BT) - This is a rare and vulnerable species (Applegarth 1995). It is a Willamette Valley species that is known from Benton County, where it was found at the margins of a *Deschampsia caespitosa* wetland. Remnants of this habitat occur within the Long Tom Watershed.

Fender's Rhyacophilan Caddisfly (BT) - This species is known to occur in the Coast Range in Benton County and, therefore, could possibly occur in the Valley Fringe.

Montane Bog Dragonfly (BT) - This species is known from Benton County. Small numbers have been found in the forested mountains of Western States where they seem to associate with bogs and marshy areas. It could occur in the Valley Fringe.

REPTILES AND SALAMANDERS

Clouded Salamander (BA) - This species is generally associated with late-seral Douglas-fir forests. Population numbers are believed to have declined as late-seral forest habitat has declined. The District and the Valley Fringe are fairly central to the total distribution of the Clouded salamander. It is strictly an upland species and is associated with loose rocks and fallen trees, particularly large rotten Douglas-fir. There are at least 3 locations in the Valley Fringe where this salamander has been documented.

Sharptail Snake (BA) - This species was probably more widespread in the general area and the watershed in the past; however, the relatively undisturbed grass/oak woodlands that they prefer are becoming rare and more fragmented due to human modification. Currently, any population in the District is considered important because they represent the northern and most severely fragmented part of the total distribution. They have been documented on at least one site within the Valley Fringe.

BIRDS

Bufflehead (BA) and Barrow's Goldeneye (BT) - Both these waterfowl species are cavity nesters. They nest mainly on the east side of the Cascade Range but are common migratory and winter residents along the Oregon Coast and the Willamette Valley. They both are known to occur in the Long Tom Watershed at this time. The Valley fringe is not considered optimal habitat.

Pileated Woodpecker (BT) - This woodpecker is associated with forest habitats that have large trees, especially snags, for nesting and foraging. It tends to be most common in old growth Douglas-fir forest in this part of its range. They have large home ranges (over 1,000 acres) and, based on their habitat requirements, approximately 20 pairs could occupy the Valley Fringe. This is assuming that the core "old growth" stand used for nesting could be substantially less than 1,000 acres.

Loggerhead Shrike (BT) - This area is at the edge of this species distribution. It is unknown, but unlikely, that they occur along the Valley Fringe.

Lewis' Woodpecker (BT) - This woodpecker is considered rare within the Willamette Valley. It is unknown whether it was more common in the past. There may be some residents within the Long Tom Watershed.

Purple Martin (BT) - This species requires cavities for nesting and open areas for foraging. Less than 200 pairs have been documented as breeding in Oregon but they are known from the watershed vicinity including the Valley Fringe.

Western Bluebird (BT) - This species is relatively common in the watershed but competition for nest holes with introduced European Starlings is thought to be the main factor causing a decline of this species from historical numbers west of the Cascades.

MAMMALS

American Marten (BT) - Past distribution within the watershed is unknown but likely more widespread and less isolated than present occupation. This species requires forested habitats with a coarse woody debris element. They prefer mature forests with closed canopies. This species is a likely resident in the Valley Fringe.

Rare or Vulnerable (No Legal Status)

The following species are considered rare or vulnerable, and are all known or possible residents in the Valley Fringe:

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Invertebrates - **Prairie Peak Blind Carabid Beetle, Vaughn Creek Earthworm, Oregon Micro-slug, Astaneous Lepidostoman Caddisfly, Reticulate Tail-dropper**.

Amphibians - **Western Red-backed Salamander**.

BOTANY

Prior to European settlement, the Willamette Valley was once an extensive prairie/wetland ecosystem with a mosaic of riparian gallery forests and oak and pine savannas and woodlands (Smith 1949; Habeck 1961; Johannessen et al. 1971). Less than 1 percent of Willamette Valley native prairies exist today due to urban, rural, and agricultural development and succession to forested habitats (Christy and Alverson 1994). Fires set by Native Americans were historically important in shaping and maintaining Willamette Valley and forest fringe plant communities (Sprague and Hansen 1946; Habeck 1961; Habeck 1962; Thilenius 1968; Johannessen et al. 1971; Franklin and Dyrness 1973; Macky 1974; Cole 1977; Dicken and Dicken 1979; Boyd 1986; Aikens 1993). With fire exclusion after Euro-American settlement in the 1840s, composition of the remaining plant communities has shifted toward shrub and tree dominance with a concomitant decline in endemic prairie and savanna plant populations (Sprague and Hansen 1946; Thilenius 1968; Johannessen et al. 1971; Franklin and Dyrness 1973; Frenkel and Heinitz 1987). These fragmented habitats have been further degraded by various human intrusions and the introduction of numerous nonnative species (Bowen 1978; Towle 1982; Boag 1992). Today, Willamette Valley native ecosystems are some of the most endangered ecosystems in Oregon (Christy and Alverson 1994).

Willamette Valley habitat types include: upland and wetland prairie, emergent wetlands, vernal pools, ash and willow swales, oak savanna, oak and ponderosa pine woodland, riverine forest, and oxbows. A limited area including these habitats is conserved in public ownership; a majority of the intact remnants of Willamette Valley plant communities are held in private ownership. These rare plant communities support habitat for an array of rare plant species unique to these communities. Examples of most Willamette Valley plant communities can be found in the West Eugene Wetland Project area. Efforts are ongoing to conserve, enhance, and restore rare plant communities and their rare plant components on BLM as well as other public lands (Frenkel and McEvoy 1983; Frenkel and Streatfield 1994; Pendergrass 1995; Taylor 1999; Environmental Assessments 93-30,93-31, 94-29, 94-33, 95-06, 95-13, 95-27, 96-21, 96-31, 97-37, 98-26, 99-19, 99-26). A soon to be completed "Conservation Strategy" developed as a Challenge Cost Share project with The Nature Conservancy will help guide BLM in the management of those lands and the rare species that they contain. Please refer to the West Eugene Wetlands Plan (1992) and references cited in this chapter for additional information concerning the West Eugene Project Area and unique plants and communities of the Willamette Valley.

SPECIAL STATUS SPECIES

Surveys for Special Status Species (SSS) vascular plant species have been and should continue to be conducted within the watershed. These surveys have usually been associated with project clearances to ensure adherence with the Endangered Species Act (1973), the Northwest Forest

Plan (1994), and the Eugene District Resource Management Plan (RMP 1995). These surveys have primarily been botanical clearances in support of other resource programs such as timber management, wildlife enhancement, recreation projects, special use permits, etc. Wetland mitigation and management work have also prompted botanical surveys on lands in the West Eugene Wetland Project Area.

At the end of 1998, a total of approximately 3935 acres within the Long Tom Watershed had received in-season field clearances for SSS plants. Thus, about 1.5 percent of all lands and 18 percent of BLM lands in the watershed have been surveyed for SSS plants.

These botanical surveys have been relatively evenly distributed over the entire watershed area and thus should be fairly representative of the watershed. Although survey efforts should continue, complete coverage of the watershed is not expected because of personnel and budget restrictions. The overall species occurrence "picture" will improve and provide a better base on which to make management decisions as additional acres are surveyed in the watershed. A map showing lands with botanical surveys for the watershed is located in the Coast Range Resource Area Botany files.

Status designations - Different levels of status signify varying levels of needed conservation and management. The following definitions of BLM status designations are quoted or based on information contained in Information Bulletin No. OR-2000-092, dated EMS Transmission 01/26/2000.

In the BLM, Special Status species include (in their order of level of management consideration): 1) Federally listed Endangered and Threatened species, 2) Bureau Sensitive, and 3) Bureau Assessment. Bureau Tracking is not a BLM Special Status species designation, rather it is a special designation in Oregon and Washington only and is a lower status to the aforementioned categories.

Bureau Sensitive - According to the definition in the Bureau 6840 policy, BS designation includes species that could easily become endangered or extinct in a state. They are restricted in range and have natural or human-caused threats to survival. BS species are designated by the State Director and are tiered to the Oregon Natural Heritage Program designations. Bureau 6840 policy requires that any Bureau action will not contribute to the need to list any of these species.

Bureau Assessment (BA) - is a category that pertains to Oregon and Washington BLM only per the OR/WA BLM 6840 policy. Plant and wildlife species which are not presently eligible for official federal or State status but are of concern in Oregon or Washington may, at a minimum, need protection or mitigation in BLM activities. These species will be considered as a level of special status species separate from BS, and are referred to as BA species.

Clearance for BA species will be done subject to limitations in funding and/or positions. Impacts will be determined and recommendations for the species will be considered on a case by case basis through the NEPA process and in balance with other resource considerations. Where possible, measures should be taken in project planning to protect the species.

Bureau Tracking (BT) - To enable an early warning for species which may become of concern in the future, districts are encouraged to collect occurrence data on species for which more information is needed to determine status within the state or which no longer need active management. Until status of such species changes to federal or state listed or proposed, FC, BS or BA species, BT will not be considered as special status species for management purposes.

In addition to species of interest at the State and Federal levels, a number of species are considered of interest that are tracked within Lane County for purposes of maintaining diversity at a more local level.

SPECIES OF INTEREST

A total of 22 species of interest on the Eugene District BLM had been located on BLM lands in the Long Tom watershed by the end of 1999 (see Appendix B). Sixteen of these species occur exclusively in the unique Willamette Valley habitats found within the West Eugene Wetlands Project area. Currently, there are approximately 1300 acres of land owned by BLM within the West Eugene Project area. These lands represent only 0.5 percent of the total Long Tom Watershed area and approximately 6 percent of BLM holdings yet support critical habitat for a majority of the species of interest in the watershed. Approximately 536 acres or 41 percent of the current BLM West Eugene Project lands have received multi-season surveys for SSS plants. Land purchases are continuing in the Wetlands Project area and are expected to reach a total of about 2000 acres. Although West Eugene Wetland Project lands provide critical habitat for numerous species of interest and populations of these species are being actively managed, this document will not provide an in-depth treatise of this portion of the watershed or those species unique to these habitats. Please refer to referenced material in this text and the West Eugene Wetlands Plan (1992) for additional information about the West Eugene Project Area and unique plants and communities of Willamette Valley ecosystems.

RESEARCH AND MONITORING

Little research has been conducted on the response of Special Status, Protection Buffer, and Survey & Manage species to changes in environmental conditions such as those typical of various management treatments. These species need to be monitored in relation to management treatments to assess methodologies for maintaining and/or enhancing populations. Some species may be intolerant of specific management treatments; thus, studies should be conducted to determine the size of effective reserves for maintenance of these species.

Studies have been initiated in the West Eugene area to look at the response of a number of rare plant species in relation to prescribed burning, mowing, and other management practices; these efforts need to be maintained and expanded upon to determine best practices for managing Willamette Valley plant communities and their rare plant components. Another study of interest would be the impact of fire and timber management treatments upon branching montia populations. Results of this research could help identify opportunities to enhance populations of this plant in conjunction with timber sales or opportunities to enhance late-successional forest structure.

THE FOREST FRINGE HABITAT

A lesser number of species (6) of SSS plants occur in the forested ("fringe") habitat along the western edge of the Long Tom Watershed, which is the BLM's area of primary focus for this Watershed Analysis. Those species of forested habitats found on BLM lands in the watershed include the "Bureau Sensitive" species: wayside aster (*Aster vialis* - also a Survey and Manage species) and tall bugbane (*Cimicifuga elata*); "Bureau Tracking" species: branching montia (*Montia diffusa)* and broomrape (*Orobanche pinorum*); the "Survey and Manage" vascular species: candystick (*Allotropa virgata*); and a species of interest in Lane County: rosinweed (*Calycadenia truncata*).

A treatise on each of these forest fringe species known to occur in the Long Tom Watershed is provided below. Candystick is treated in this section as surveys began about 1994, and thus earlier than the 1998 start of surveying for the Survey and Manage nonvascular species.

Allotropa virgata (candystick) is a Survey and Manage species. "*Allotropa virgata* is found in deep humus of coniferous forests at lower elevations, east slope of the Cascades to near the coast, from British Columbia to California. . . . It is widespread, but formerly perceived as rare throughout the range" (Wogen and Lippert 1998). The center of distribution for the species appears to be in higher elevations of the Cascade Range and in Coastal Dune plant communities. Few populations occur in the Coastal Range. *Allotropa virgata* is known to form a complex association with a fungus and overstory trees There is one known site of this species located in the Long Tom Watershed referred to as the Woody Hayes population. This is a relatively large population (50+ stems) for the Coast Range and occurs in about a 60 year old Douglas-fir stand. The botanical recommendation for management of this population would be to leave the site undisturbed.

Aster vialis (wayside aster) is a Bureau Sensitive and S&M species that "is considered a Willamette Valley endemic (Gamon 1986) and is found primarily within the Willamette Valley Physiographic Province with a few sites found along valley margins of the eastern Coast Range Physiographic Province (Franklin and Dyrness 1973)" (Wogen 1998). The "species preferred habitat is thought to have been historically sustained by frequent fire return intervals that create open forest conditions with widely spaced conifers" (Wogen 1998). Other gap agents may be important in the maintenance of Aster populations including root rot pockets, rodent actions, and poor and/or thin soils.

There is one known site of this species located on BLM lands in the Long Tom Watershed It is a relatively small population growing on a steep and rocky road embankment. The rocky site maintains a suitably open site for *A. vialis*. Continued dormant season mowing to keep weeds from dominating the ditch is recommended.

Calycadenia truncata (rosin weed) is a species of interest because it rarely occurs within Lane County. Hickman (1993) describes it as common on dry, open hillsides, rocky ridges, and talus below 1500 meters in California and Oregon. The one known location of this plant in the Long Tom Watershed is in the Fox Hollow RNA in a natural dry meadow. Continued management of the Fox Hollow area as an RNA will assure protection of this population.

Cimicifuga elata (tall bugbane) is a Bureau Sensitive species known from British Columbia to southern Oregon, west of the Cascade Range (Kaye and Kirkland 1993). In the Eugene District, this species is generally concentrated at the foothills of the Coast and Cascade Ranges "fringing" the Willamette Valley floor. Frequent fires and other agents of disturbance that once kept this area a mosaic of forests, forest gaps, and open woodlands, may be responsible for its current pattern of occurrence. Suppression of disturbance-causing processes and the management of stands for plantation timber production, along with rural and agricultural development, are thought to be reducing the amount of appropriate habitat for this species today. Refer to the Conservation Strategy for *Cimicifuga elata* (1996) and various Challenge Cost Share reports in District files for a full treatise on the life history, distribution, and management practices and protections for this species.

Surveys to date indicate that 11 sites of tall bugbane occur on BLM lands and one additional private site occurs in the Long Tom Watershed. All sites are scattered along the fringe area where the Coastal Range meets the Willamette Valley floor, particularly toward the northern and southern ends of the Long Tom Watershed boundaries. Approximately 167 acres of botanical reserves have been established for protection and management of populations or this species in the Long Tom Watershed.

Management recommendations for each of these sites were included in a Conservation Strategy developed in 1996. Recommendations for those sites in the Long Tom Watershed are reproduced from that document in Appendix B. BLM should continue to monitor identified populations and begin implementation of management actions identified in the Conservation Strategy to enhance conditions for the species at sites.

Montia diffusa (branching montia) is a BLM Tracking species known from northern California to British Columbia (Hickman 1993) and is found in all Eugene District Resource Areas. Survival of this species is thought to be linked to disturbance, particularly to periodic fire. Fire suppression and reduced use of prescribed burning as a silvicultural practice appear to be threats most important to this species.

There is one site of branching montia located in a young stand (~10 years old) where prescribed fire was used to prepare a clear cut unit for replanting. No further treatments of this site seem practicable at this time. A general botanical recommendation would be to utilize prescribed burning where possible for site preparation following harvest regeneration timber activities. This would help assure the perpetuation of distributed populations of branching montia.

Orobanche pinorum (pine broomrape) is an uncommon species of coniferous woods occurring from Washington and northern Idaho to northwest California (Hitchcock et al. 1959). It is believed to be parasitic on ocean spray (*Holodiscus discolor* - Hickman 1993).

There are two known sites of this species located in the Long Tom Watershed. One of these sites is located on private land near the northeasterly boundary of the Coast Range Resource Area. A second site is located within the Fox Hollow ACEC/RNA in the South Valley Resource Area. The BLM population should remain protected within this special area designation.

PROTECTION BUFFER AND SURVEY & MANAGE PLANTS

Protection Buffer (PB) and Survey & Manage (S&M) plant species were identified during the formation of the Northwest Forest Plan (1994) to be considered under ecosystem management. Four "Component" categories were identified for S&M species:

Component 1 - manage known sites.
Component 2 - survey for species prior to ground disturbing activities that will be implemented in 1999 or beyond.
Components 3 and 4 - conduct regional surveys to determine species distributions.

Surveys for PB and Component 2 S&M species began during spring 1998 on the Eugene BLM District. Currently, BLM is not required and does not systematically survey for Survey and Manage Component 1, 3, or 4 species. When Component 1 species are located during the course of other work, BLM accordingly records, maps, and manages these "known" sites.

Surveys for Survey & Manage, Component 2, vascular plants, candystick (*Allotropa virgata*) and wayside aster (*Aster vialis*) had begun prior to publication of the Northwest Forest Plan (1994) as these species had been considered species of interest to be surveyed for. Description and management of wayside aster and candystick are located in the preceding section.

As of fall 1999, only four proposed project areas involving approximately 241 acres (0.09% of the watershed and 1.1% of BLM ownership) have been searched for PB and S&M species in the Long Tom Watershed. Two Protection Buffer species have been located in the Long Tom Watershed including a moss, *Ulota megalospora*, and a fungi, *Sarcosoma mexicana* (which is also a Component 3 Survey and Manage fungi). Additionally, one S&M Component 1 and 3 fungi species, *Helvella compressa*, and one S&M Component 1 and 3 lichen species, *Loxosporopsis corallifera*, have been found at one location each in the Long Tom Watershed. All species identified in the Long Tom Watershed are occurring with some frequency across the Eugene District and appear to be more widespread and abundant regionally than was thought prior to recent survey efforts. All species that have been located thus far in the Long Tom Watershed are being considered for delisting from the list of species in the Northwest Forest Plan (1994) warranting special consideration.

When PB and S&M Component 1 and 2 species are found in project areas, BLM is referring to bryophyte, lichen, and fungal experts and official management recommendation documents to determine appropriate management for individual sites (1996 Draft Management Recommendations for Bryophytes, Installment 1, pp 18:3-6; Castellano and O'Dell 1997).

To date, limited information is available on the distribution and life history of Protection Buffer (PB), Survey and Manage (S&M), and other nonvascular plant species. Studies on the life histories of PB and S&M species would provide insights into management impacts and opportunities to maintain and/or enhance populations of these species.

Surveys for PB and S&M species should be increased in the future through contracts and in-house efforts. Most importantly, regionwide surveys (outside of planned project areas) for PB and

S&M species should be conducted by the BLM State Office or the Regional Ecosystem Office to determine the true distribution and extent of populations of these species. The status of certain S&M and PB species may change with the completion of the ongoing supplemental EIS.

SPECIAL HABITATS

No specific field inventories for special habitats have been conducted in the Long Tom Watershed at this time. The closest estimate of acres of special habitats present within the "forest fringe" of the Long Tom Watershed was derived from a GIS layer entitled the Timber Production Capability Classification (TPCC). The TPCC layer includes steep, fragile and/or non-timbered lands that are withdrawn from the land base that BLM manages for timber production. These TPCC withdrawal areas range from 1 to 123 acres in size and total 798 acres for the watershed. TPCC classifications were grouped to arrive at two classifications for the forest fringe area of the Long Tom Watershed; 64 sites and 558 acres of rock/steep, and 49 sites and 240 acres of water. The steep classification would not be indicative of special habitats but represents land withdrawn from timber production because timber removal would lead to a moderate to high probability of landslides in those areas. The "rock" type could potentially indicate the presence of cliff, talus slopes, or rock outcrop types of special habitats. The "water" type might indicate the presence of wet meadows, ponds, marshes, swamps, or other types of wetland areas. TPCC classifications are not equivalent to special habitats, and do not illuminate features important in managing special habitats. Little specific information is known about special habitats found in the Long Tom Watershed.

All lands within the West Eugene Wetland Project area would be considered special habitat within the context of the Long Tom Watershed. These lands encompass approximately 1300 acres located in the vicinity of west Eugene, Oregon. This area includes some of the last remaining intact remnant native Willamette Valley plant communities.

SPECIAL AREAS

Special Areas are defined as Areas of Critical Environmental Concern (ACEC), Research Natural Areas (RNA), Outstanding Natural Areas (ONA), or Environmental Education Areas (EEA) and are to be managed to maintain and enhance the primary values for which they were designated (RMP 1995). Fox Hollow ACEC/RNA, Long Tom ACEC, and the Lorane Ponderosa Pine Potential ACEC (two sites) are located in the Long Tom Watershed.

Fox Hollow ACEC/RNA was established in 1984 to provide a 160-acre example of dry-site, mature Douglas-fir and ponderosa pine (*Pseudotsuga menziesii/Pinus ponderosa*) forest in the Willamette Valley foothills (RMP 1995; BLM 1996; Curtis 1986). The Long Tom ACEC was designated in 1984 to provide a 6-acre example of Willamette Valley native plant communities (RMP 1995). The Lorane Ponderosa Pine Potential ACEC (two 40-acre units) was reviewed as units to represent Willamette Valley ecotype ponderosa pine community. After field review in 1998 (Hibbs et al. 1998), it appears that these units may more appropriately represent dry-site mature Douglas-fir (with some pine component) community in the Willamette Valley foothills.

The Fox Hollow RNA/ACEC has been withdrawn from reciprocal right-of-way agreements for the construction of new roads. Withdrawal from mineral entry claims was recommended in the Eugene District RMP (1995) but awaits adequate staffing to complete. The RNA is checked for threats such as Off-Highway Vehicle (OHV) use, weed infestation, and trespass. Botanical, wildlife, and noxious weed inventories have been conducted and periodically will be updated. Other future management actions may include photo-documentation for vegetation changes over time and more extensive botanical inventories.

Development of a management plan for the Long Tom ACEC is on hold until a contracted Conservation Strategy for the West Eugene Wetlands is completed to ascertain how the ACEC fits into a larger conservation effort. During the next planning cycle, the entire West Eugene Wetlands Project area could be considered for designation as an ACEC. In the interim, various site treatments and monitoring are on-going, including photo-documentation; detailed monitoring of vegetation and rare plant populations that are conducted in-house and with Challenge Cost Share cooperators; disturbance treatments, prescribed burning, manual tree and shrub removal for prairie community, and rare plant enhancements.

Additional potential Special Areas should be evaluated and proposed in concert with inventories of special habitats and as plant association and other information is collected on the Eugene District. All Proposed Special Area sites will be reviewed during the next planning process for Special Area designation.

NONNATIVE AND NOXIOUS PLANTS

The species composition of the Long Tom Watershed area has been modified by accidental and deliberate introduction of nonnative (introduced to the flora of Oregon after European settlement) plant species (Bowen 1978; Towle 1982; Boag 1992). A number of nonnative species are now naturalized in this watershed that were intentionally introduced as orchard, food-crop, hedgerow, and ornamental plants (e.g., pear -*Pyrus communis*, sweet cherry - *Prunus avium*, domestic apple - *Pyrus malus*, English hawthorne - *Crataegus monogyna*, sweetbriar - *Rosa eglanteria*). Other nonnative species arrived in association with livestock, various types of cargo, ballast, and in imported agricultural seed mixes. A species list of grasses in Salem and vicinity in 1919 indicated that 52 percent of the species were introduced (Nelson 1919). Although little data are available for Oregon, the Willamette Valley, or the Long Tom Watershed, it may be assumed that a great number of nonnative species are present in the composition of modern-day plant communities of the Long Tom Watershed area.

Noxious plants are defined as "Plant species designated by Federal or State law as generally possessing one or more of the characteristics of being aggressive and difficult to manage, parasitic, a carrier or host of serious insects or disease, and being nonnative, new to, or not common to the United States" (USDI, BLM 1994). Oregon Department of Agriculture determines which plant species are legally designated as noxious in the State of Oregon. Roads are a primary medium for the establishment and expansion of most noxious and nonnative plant species on BLM forest land. Contaminated gravel and fill, spread of weed seed by road construction, maintenance, and other disturbance activities, and introduction of new weed species by recreational vehicles and equestrians are factors in the relationship of roads and noxious weeds.

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A 1996 noxious weed survey on BLM lands identified widespread, low to moderate concentrations of Scotch broom (*Cytisus scoparius*) along roadways within the Long Tom Watershed area. Scattered spot locations of meadow (*Centaurea pratensis*) and spotted knapweed (*Centaurea maculosa*) are known to occur on State and Lane County roads on the Valley floor and Coast and Cascade Range foothills. Purple loosestrife (*Lythrum salicaria*) is also known to occur in spot locations on private lands along the Willamette River and tributaries, including tributaries of the Long Tom River.

Development of an integrated pest management plan that includes noxious weed control in the Long Tom Watershed is needed to reduce noxious weed populations below levels that impair the viability of native species. A District-wide inventory of noxious weed infestations was conducted in 1996 and mapped into GIS during 1997. Not all roads were surveyed during this effort and additional ground truthing should be conducted prior to establishing contracts for noxious weed control.

VEGETATION

Vegetation Conditions (1956) - Vegetation patterns for this period were generated from the 1956 Lane County type maps (USDA Forest Service 1956). The maps titled "1956 Vegetation in Coast/Long Tom " and "1956 Vegetation in South/Long Tom " depict the vegetation pattern within the Long Tom valley fringe based upon a conversion of the forest type map to the vegetation classes used for current vegetation. Figure III-1 summarizes the 1956 vegetation class distribution within this analysis area.

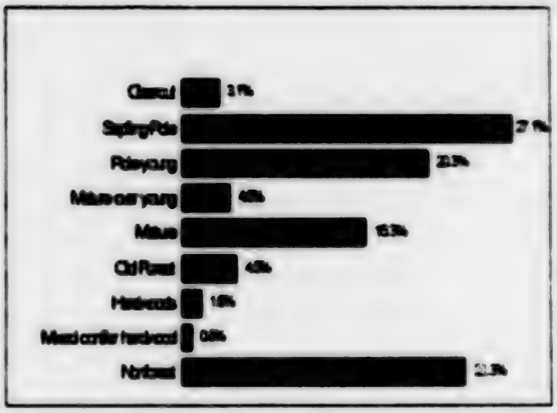

Figure III-1 1956 Vegetation Long Tom Fringe Analysis Area (Thrailkill Vegetation Data)

Vegetation classes based on 1956 vegetation type data are described below (also see Appendix Table C-1). The overall average patch size for the lands typed within the analysis area in 1956 was approximately 61 acres. The unclassified lands were not used in the calculation of the average patch size.

Clear Cuts - The average patch size of the clear cuts was 52 acres. The clear cut vegetation class totaled approximately 2,992 acres or only 3 percent of the analysis area within the watershed. These clear cuts were scattered throughout the analysis area with the largest concentration of clear cuts located centrally within the Coast-Long Tom analysis area of the watershed within townships T16S - R6W and R7W; and T17S - R6W and R7W.

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Sapling-Pole - This vegetation class was distributed throughout both the Coast-Long Tom and South-Long Tom analysis areas of the watershed in the upland forest adjacent to the lower nonforest lands. The sapling pole vegetation class represented the largest number of acres (26,414 acres) within the analysis area. The average patch size of the sapling pole vegetation was approximately 100 acres. Approximately 27 percent of the analysis area was classified as sapling-pole forest in 1956.

Pole-Young - The pole young vegetation was scattered throughout the analysis area with the largest block of this vegetation class occurring in the southern tip of the Coast-Long Tom analysis area. The average patch size of these stands was approximately 58 acres. There were approximately 19,800 acres of pole-young forest within the analysis area surveyed. This vegetation classification represented 20 percent of the analysis area in 1956.

Mature over Young - There were only 3,903 acres of land (5% of the analysis area) classified as mature over young in 1956. This vegetation class occurs in smaller more scattered patches than the other vegetation classes.

Mature Forest - The lands mapped in 1956 as mature forest were found most concentrated in the northwest portion of the Coast-Long Tom analysis area of the watershed and is fairly evenly distributed within the South-Long Tom analysis area of the watershed. There were approximately 14,909 acres of mature forest with an average patch size of 84 acres mapped within the Lane County 1956 vegetation survey. Approximately 15 percent of the analysis area within the watershed was in mature forest.

Old Forest - Blocks of old forest were primarily located in the northeast and central portion of the Coast-Long Tom analysis area with more widely scattered parcels across the remainder of the area. The South-Long Tom analysis area contained very little (114 acres) of Old forest. There were approximately 4,410 acres of Old forest with an average patch size of 80 acres mapped within the Lane County 1956 survey within the analysis area of the watershed. Approximately 5 percent of the analysis area was in Old forest at the time of the survey.

Hardwoods - There were a total of 1,544 acres (2 percent of the analysis area) classified as hardwoods in the 1956 Lane County lands survey. A good portion of this can be contributed to riparian stream side vegetation; however, there appears to be a concentration of extremely large patches of upland hardwoods located in T17S R7W Section 25 and T17S R6W Sections 30 and 31 west of Noti, indicating some upland disturbance in which hardwoods gained occupancy of the site in this area.

Vegetation Conditions (1997)

The Long Tom Watershed as of 1997 was highly fragmented in respect to the distribution of trees among the various vegetation classes. The vegetation pattern reflected the checkerboard land ownership pattern within the watershed and years of intensive forest management. The overall average patch size in 1997 was approximately 37 acres. The maps titled "1997 Vegetation in Coast/Long Tom" and "1997 Vegetation in South/Long Tom" depict the current vegetation pattern within the analysis area of the watershed. Figure III-2 summarizes the 1997 vegetation class distribution within the watershed.

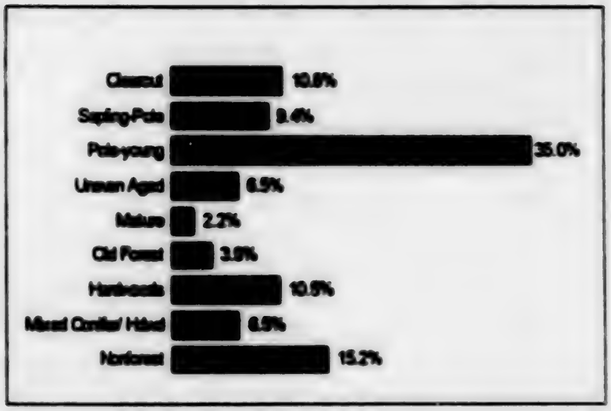

Figure III-2 1997 Vegetation Long Tom Valley Fringe Analysis Area (Thrailkill Vegetation Date)

Clear Cut and Sapling-Pole - These vegetation classes combined account for 19,681 acres or 20 percent of the analysis area. These youngest vegetation classes are fairly evenly distributed throughout the analysis area. Larger concentrations of these two vegetation classes appear to be present in the central to west portion of the Coast-Long Tom analysis area of the watershed within T16S R6W and T16S R7W and in the southern end of the Coast-Long Tom analysis area within T18S R6W. The average patch size of the clear cuts and sapling-pole stands are approximately 37 acres and 41 acres, respectively.

Pole-Young - This vegetation class is scattered heavily throughout the analysis area in large contiguous patches. The pole-young vegetation class accounts for 34,127 acres or 35 percent of the analysis area and is the most frequent vegetation class encountered. The mean patch size of this vegetation class within the analysis area was 75 acres.

Mature Over Young and Old Over Young - These uneven-aged vegetation classes combined account for 6,314 acres or 6 percent of the analysis area of the watershed. The mature over young vegetation class appears to be more prevalent in T17S R7W and in the northern area of T16S R6W stretching farther north into T15S R6W. The largest concentrations of old over young occur in T17S R7W and in the northeast corner of the analysis area within T15S R6W. The average patch size of the mature over young and old over young patches are approximately 20-30 acres.

Mature and Old Forest - The mature and old forest vegetation classes combined account for approximately 5,865 acres or 6 percent of the analysis area. Mature forest areas are small isolated remnants widely scattered within the analysis area of the watershed. The largest patch of mature forest occurs in the southeast corner of T15S R6W. The old forest within the analysis area is found in larger patches or concentrations scattered throughout both the Coast-Long Tom and South-Long Tom analysis areas of the watershed. The average patch size of the mature and old forest patches are approximately 19 acres and 36 acres, respectively.

Mixed Conifer/Hardwoods and Hardwoods - Combined, these vegetation classes account for approximately 17 percent of the analysis area. The contributing factors to this hardwood component are most likely the high rainfall received within the watershed, combined with disturbance created by past logging practices, the large stream network, and abundant hardwood seed sources within the watershed. Red alder and bigleaf maple are usually present in varying densities and can sprout prolifically after site preparation or disturbance. Mixed conifer/hardwoods and hardwoods occur heaviest in the riparian areas.

Nonforest - Approximately 14,830 acres of nonforest vegetation (15% of the analysis area) were mapped in the 1997 vegetation analysis. The nonforest exists primarily as wide lowland agricultural bands extending throughout the analysis area. These nonforest areas are present both in the Coast-Long Tom and South-Long Tom analysis areas and are more prevalent in the central to eastern portion of these analysis areas. This vegetation classification is not to be confused with those lands classified as nonforest within the Timber Production Capability Classification (TPCC) system.

Table 3-4 summarizes 1997 vegetation classes (see Maps titled "1997 Vegetation in Coast/Long Tom" and "1997 Vegetation in South/Long Tom"; and Appendix Tables C-3 and C-4). Vegetation classes are described in detail in Appendix C.

Table 3-4 - 1997 Vegetation Classes - All Lands -
Long Tom Valley Fringe Analysis Area

Vegetation Class	Total Acres	Percent	Number of Patches	Percent of Total Patches	Mean Patch Size
Clear Cut	10,494	10.8	282	10.7	37
Sapling-Pole	9,187	9.4	222	8.4	41
Pole-Young	34,127	35.0	454	17.2	75
Mature over Young	3,333	3.4	164	6.2	20
Mature	2,109	2.2	111	4.2	19
Old over Young	2,981	3.1	100	3.8	30
Old Forest	3,756	3.9	104	3.9	36
Hardwoods	10,238	10.5	532	20.1	19
Mixed-	6,360	6.5	361	13.7	18
Nonforest	14,830	15.2	312	11.8	48
Totals	97,415	100.0	2642	100%	37

Plant Communities

The terrestrial vegetation ecosystem in the Long Tom valley fringe analysis area can be characterized by 2 major plant groupings. The major groupings are an aggregation of plant communities with similar management potentials, the same principal early seral species, and the same dominant late seral conifer species. The following are in the Long Tom valley fringe analysis area:

Douglas-fir/red alder/vine maple - These plant communities are found on the drier sites on eastern slopes of the Coast Range and occur on the majority of the Long Tom valley fringe. Douglas-fir and western hemlock are the common overstory species. Shrub species include evergreen huckleberry, blackberry, and salal. Red alder and bigleaf maple are usually present in varying densities and sprout prolifically after site preparation. The herb layer when present consists of swordfern and oxalis. Plant communities vary depending on the presence of marine air flow across the Coast Range. Dry sites have more oceanspray and herbaceous competitors than moister sites.

Douglas-fir/ocean spray/herbs and grasses - These plant communities are found adjacent to the valley floor (east of the Lorane highway) on warm, dry sites at low elevations (less than 1,500 feet). Climax tree species may be western hemlock, Douglas-fir, or Oregon white oak. Other species that may be present are incense cedar, ponderosa pine, grand fir, bigleaf maple, and madrone. The shrub layer consists of hazel, ocean spray, vine maple, Oregon grape, and poison oak. Following disturbance, grasses and herbs become significant components. Most of these sites have a higher-than-average fire occurrence on the Eugene District historically.

Succession and Disturbance

SUCCESSION is a series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax. An example is the development of series of plant communities (called seral stages) following a major disturbance. A general description of seral stages is in Appendix C - Seral Stages.

DISTURBANCE (natural, anthropogenic, and post-European settlement) have all influenced the character of the vegetation across the landscape over time. Four major types of natural disturbance occur within the Long Tom Watershed analysis area: wind, floods, landslides, and fire.

The most frequent and widespread strong winds occur from the southwest and are associated with storms moving onto the coast from the Pacific Ocean. These strong westerly winds from the coast are often slowed down and obstructed by the north-south alignment of the Coast Range to the west reducing some of the strong influence from these west winds within the interior valley regions. Some of the most destructive winds are those winds that blow from the south, parallel to the major mountain ranges. The Columbus Day Storm of 1962 was one of these destructive south wind storms. The Columbus Day Storm developed off the coast of California and moved from the southwest and then turned, coming directly from the south and toward the south Oregon coast. The Columbus Day storm was the most destructive wind storm to occur in Oregon both in loss of life and property damage. Damage was the most severe in the Willamette Valley. Other wind storms of high intensity that have affected the Oregon Coast Range (and often the Willamette Valley) occurred in 1880, 1921, 1931, 1951, 1955, 1958, 1963, 1967, 1971, and 1981 (NOAA - 1999).

Severe windstorms periodically create extensive blowdown, sometimes in concentrated areas, but usually in wider and more scattered distribution (Teensma et al. 1991). The Columbus Day Storm caused blowdown in concentrations of over 80 acres per square mile, although considerably more area received blowdown of 10-39 acres per square mile (Teensma et al. 1991).

The last major floods in recent times were the "Christmas Flood" (late December 1964) and the "Floods of 1996". The "Christmas Flood" was triggered by a rain-on-snow event. Based upon anecdotal information, because of heavier snow pack the impact of this flood was more severe in the Cascade Range and the Willamette River Basin than in coastal streams. The "Floods of 1996" occurred in February and November. The February 1996 storm was a high intensity, long duration, rainfall event. Soils were saturated, and the run-off was rapid from frozen ground and a melting snow pack. The November 1996 storm was a shorter duration and higher intensity rainfall event. The November storm occurred early in the season, predominantly at lower elevations in Oregon's Willamette Valley and Coast Range. Because of this, it lacked a rain-on-snow component, and soils were not saturated prior to the storm event (Robinson et al. 1997).

Mass wasting or the downslope movement of soil and rock material through a variety of landslide movement types (shallow translational failures, debris avalanches, and torrents) is a dominant physical process that created the land forms that make up the Long Tom Watershed. Mass wasting is a natural process within the watershed, although the natural frequencies and magnitudes can be influenced by human activity. Mass wasting as a process is further described under the "Soil Erosion" section in this chapter. The effects of mass wasting in relation to stream channels within the watershed and fisheries is further discussed within the "Fisheries" section in this chapter of the watershed analysis.

The characteristic fire regime in the Oregon Coast Range was one of infrequent high severity wildfires with more than 200 years between burns and with considerable spatial variability associated with the estimate (Agee 1993). Reconstructive studies of past fire occurrence in the Oregon Coast Range showed extremely large-scale fires burned across entire watersheds (Teensma et al. 1991). Historically, the Willamette Valley side of the Coast Range probably burned much more frequently than did the Coastal side. Climatologically this is expected but the increase in frequency of burning is probably much more related to human factors. Encroachment of Willamette Valley prairie ecosystems by Douglas-fir dominated forest after European settlement has been well documented and is attributed to the ending of periodic grassland burning by aboriginals (Teensma et al. 1991). Early wildfire related disturbance specific to the Long Tom Watershed is addressed in the disturbance regime sections of the early vegetation analysis and has been captured on the 1936 timber type map.

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The early anthropogenic fire history specific to the Long Tom Watershed and its influence in the development and maintenance of the prairie and prairie/savannah vegetation within the watershed, and its influence on the forested vegetation patterns of the adjacent hills is addressed in the prehistory and ethnographic section of this chapter and in the early vegetation history of this chapter. The early vegetation maps are reflective of some of this fire history.

Each year there are also local minor disturbance events caused by snow (broken tree tops, leaning and fallen trees), wind (blowdown and broken top trees), diseases (dead pockets and blowdown of trees), and insects (dead trees and defoliation). Disturbances of these types, although small, can greatly influence the biotic diversity within the stand. Many small openings/gaps are created in an otherwise dense forest stand.

In recent history, the Long Tom Valley Fringe analysis area has been most impacted by humans. These impacts have included agriculture, forest management, fire suppression, and introduction of exotic species.

LATE-SUCCESSIONAL RESERVES LAND USE ALLOCATION (LUA)

There are approximately 7,838 acres of Late-Successional Reserve (LSR) within the Long Tom valley fringe analysis area. The LSR makes up approximately 38 percent of the BLM administered lands within the analysis area and approximately 8 percent of all lands within the Long Tom valley fringe. The LSR is predominantly young and fragmented with approximately 4,179 acres or 53 percent less than 80 years old (i.e., clear cut, sapling pole, and pole-young vegetation classes using (Thrailkill vegetation data). The mature and old forest (i.e., ≥80 years) using Thrailkill vegetation data make up approximately 21 percent of the LSR. An additional 10 percent of the LSR is in unevenaged stands (mature over young and old over young) that may provide some late-successional habitat characteristics. Hardwoods and mixed conifer hardwoods make up approximately 15 percent of the LSR.

RIPARIAN RESERVES LAND USE ALLOCATION (LUA)

Riparian Reserves, as defined by the ROD (USDA FS and USDI BLM 1994) are "areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receive primary emphasis." The ROD sets interim widths for Riparian Reserves based upon 5 categories of streams and water bodies. These reserve widths apply across all LUAs. Based on calculations using these widths, and assuming a maximum site-potential tree height of 210 feet (REO 1994), approximately 9,389 acres of BLM lands within the Long Tom Watershed fringe analysis area are tentatively identified as Riparian Reserves. Nonfish-bearing streams received a one-site tree buffer (approximately 210 ft.) each side of the stream and fish-bearing streams received a 2-site tree buffer (approximately 420 ft.) each side of the stream as defined in the ROD.

Appendix Table C-4 summarizes the amount of Riparian Reserve by each of the major LUAs for all forested BLM lands (includes BLM forested lands outside the Long Tom fringe analysis area).

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The Riparian Reserve ranges from 46 to 83 percent of the land use allocations (LUAs) within all forested BLM lands. The Riparian Reserves averaged 46 percent of the BLM forested ownership.

Appendix Table C-5 summarizes the acres and percent of each vegetation class (Thrailkill vegetation data) within the Riparian Reserves on BLM lands and all lands within the Long Tom valley fringe analysis area. The younger age classes (clear cut, sapling pole, and pole-young) make up approximately 50 percent of all lands in the Riparian Reserves within the valley fringe analysis area. Hardwoods and mixed conifer hardwoods make up an additional 25 percent of the vegetation within the Riparian Reserve. These vegetation classes, when combined with the nonforest vegetation class, account for approximately 83 percent of the vegetation within the valley fringe analysis area. Mature and old forests account for only 9 percent of the Riparian Reserve within all lands within the valley fringe analysis area as modeled.

Approximately 58 percent of the Riparian Reserves within the BLM ownership are in the younger age classes (clear cut, sapling pole, and pole-young). Hardwoods and mixed conifer hardwood make up an additional 18 percent of the BLM ownership within Riparian Reserves. BLM has less then one percent of its ownership within the valley fringe analysis area in nonforest. Mature and old forests account for only 14 percent of the Riparian Reserve within BLM ownership within the valley fringe analysis area as modeled.

RIPARIAN AREAS

The riparian area is an interface between the aquatic and terrestrial ecosystems. Riparian areas provide major travel corridors for a variety of wildlife species. Riparian areas are a major source of inputs into the aquatic system in the form of wood, food sources, and nutrients.

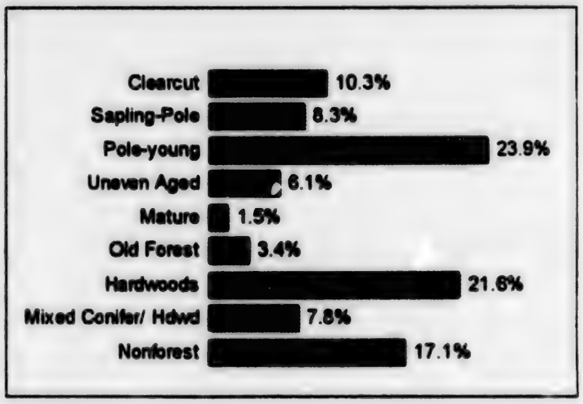

Figure III-3 Stream side Vegetation Long Tom Valley Fringe Analysis Area (Thrailkill Vegetation Data)

Streamside Vegetation - To characterize stream side overstory vegetation and to allow the identification of existing sources for large woody debris recruitment to the stream system, a GIS map of 2nd order and larger streams was developed by mapping the area up to 100 feet on each side of stream center across all ownerships. A distance of 100 feet was selected because 90 percent of the woody material that falls into streams comes from within 100 feet of the stream (McDade 1989). This layer was then intersected with a GIS-produced vegetation layer using 1994 Thrailkill vegetation data updated to 1997 (see Appendix Table C-6 and maps relative to stream side vegetation). Figure III-3 summarizes stream side vegetation class distribution for 2nd order and higher streams. Appendix Table C-6 provides a characterization of stream side vegetation in relation to stream order for both private and BLM lands.

Streamside Ownership - Appendix Table C-7 shows the percentage of ownership (private and BLM) for 2 groupings of streams by stream order (1st, 2nd, and 3rd order streams; and 4th order and larger streams) within the valley fringe analysis area of the Long Tom Watershed. This data was derived from the GIS-produced stream side vegetation map of 2nd order and larger streams, using a 100-foot distance each side of stream center across all ownerships. The data applies to the land area within these 100-foot distances only.

Land ownership and pattern of ownership along the streams are important because they determine BLM's ability to manage aquatic and riparian resources to the benefit of all species. To manage for these species it may be necessary to enter into cooperative agreements both with the public and with private and/or State agencies. Within the Long Tom valley fringe, BLM manages only 26 percent of the vegetation along 1st, 2nd, and 3rd order streams and only 8 percent of the vegetation along 4th order and larger streams within the watershed. The BLM manages only 23 percent of the vegetation of all streams within the valley fringe analysis area.

Matrix Land Use Allocation

General Forest Management Area (GFMA) - There are approximately 10,542 acres of GFMA within the Long Tom valley fringe analysis area. The GFMA makes up approximately 52 percent of the BLM administered lands within the analysis area and approximately 11 percent of all lands within the Long Tom valley fringe. The vegetation within the GFMA is predominantly young with approximately 6,645 acres or 63 percent less than 80 years old (i.e., clear cut, sapling pole, and pole-young vegetation classes using Thrailkill vegetation data). The mature and old forest (i.e., ≥80 years) using Thrailkill vegetation data make up approximately 11 percent of the GFMA lands. Hardwoods and mixed conifer hardwood stands make up approximately 13 percent of the GFMA.

Connectivity - There are approximately 1,962 acres of Connectivity within the Long Tom valley fringe analysis area. The Connectivity makes up only 9.7 percent of the BLM administered lands within the analysis area and approximately 2 percent of all lands within the Long Tom valley fringe. The Connectivity, like the GFMA, is predominantly young with approximately 1,261 acres or 64 percent less than 80 years old (i.e., clear cut, sapling pole, and pole-young vegetation classes using Thrailkill vegetation data). The mature and old forest (i.e., ≥80 years) using Thrailkill vegetation data make up approximately 30 percent of the Connectivity lands. Approximately 1 percent of the Connectivity is in unevenaged stands (mature over young and old over young) that may provide some late-successional habitat characteristics.

Data Gaps and Monitoring Needs

Current Vegetation - One of the major data gaps was the lack of current forest operations inventory on lands other than BLM lands. The forest operations inventory data (FOI) that BLM uses for management of the timber base covers only BLM lands. This combined with the checkerboard ownership pattern made the vegetation coverage for the entire watershed difficult to accurately assess based on age classes for the watershed. This was mitigated by the use of

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Thrailkill's vegetation data which covered the entire watershed, regardless of ownership. Thrailkill's vegetation data was developed to classify habitat types rather than stand ages and stocking levels. Although Thrailkill's data allowed for good coverage of the entire watershed and allowed for good vegetation analysis in regard to habitat, the vegetation classes were lacking in age attributes for the hardwood and mixed hardwood vegetation types.

Historical Vegetation - Also lacking was historical vegetation data to evaluate past conditions. Historical vegetation was pieced together through research of old land survey notes, and a USDA forest type map dated 1936.

Fire History and Disturbance Events - There has been some research on fire history in the Coast Range limited to specific drainages. Other sources of research information are very general and broad and tend to be of limited value to a specific watershed. Through research of old survey notes and historical accounts BLM was able to generically describe some past disturbance events that occurred within the watershed (i.e., Columbus Day windstorm of 1964). However, there were no existing sources of information where these type of events were tracked or quantified over time. Use of these historical survey notes also required conjectural interpretation of described vegetation in relation to the disturbance that may have occurred. Knowledge of large natural disturbances and the successional pattern and stand structure that resulted have been masked or changed by more recent human disturbance (i.e., logging). This limits our understanding of both natural succession and disturbance as change elements within a watershed.

Special Habitats - TPCC classifications are not equivalent to special habitats and do not highlight the features important in managing special habitats. More field surveys are needed to identify the special habitats that exist within the watershed.

Coarse Woody Debris - While data and surveys relative to historical and current coarse woody debris levels is lacking specific to this watershed, the overall historic trend of the loss of coarse woody debris as a functional and important habitat component within stream systems, riparian areas, and uplands is well documented. Due to the absence of current down wood data within the watershed, Thrailkill's vegetation data was used within 100 feet of stream channels to estimate and evaluate the current potential for recruitment of large down wood into streams and riparian areas within the watershed. Vegetation mapping of the upland done within the analysis also reveals indirectly those areas where potential large down wood recruitment is currently limited due to the lack of old growth vegetation conditions.

Riparian Reserves - The estimations of Riparian Reserve widths and riparian areas used in this watershed analysis are inherently imprecise, because it is not possible to accurately and precisely classify streams according to the ROD definitions on a watershed-wide basis. Although the Riparian Reserve analysis was based on the most recent updated (1998) GIS Hydrological theme data, much of the mapping will need continual field verification over time to refine its accuracy, especially the occurrence of the smaller 1st and 2nd order streams. Although Thrailkill's vegetation data allowed for good coverage of the entire watershed and allowed for good vegetation analysis in regard to current habitat within the riparian, the vegetation classes were lacking in age attributes for the hardwood and mixed hardwood vegetation types.

CHAPTER 4
Interrelationships & Ecosystem Processes

This chapter discusses those ecological interrelationships and processes that are specific to understanding the Long Tom Watershed and are relevant to the Issues and Key Questions of Chapter 2, and the "past and current conditions and data gaps" of the watershed described in Chapter 3.

Comparing the current and reference conditions (if available) of various resources in the Long Tom Watershed allows an evaluation of changes in biological and physical interactions that have occurred over time, and provides a basis for interpreting current conditions in light of management objectives of the Northwest Forest Plan/ROD and the Eugene District Resource Management Plan/ROD. This information helps to design a wide variety of management recommendations and identify watershed restoration project opportunities (Chapter 5) that could be planned and implemented in the future, including Transportation Management objectives.

STREAM FLOWS

Flows in the Oregon Coast Range are as variable as the weather. The gauge on the Long Tom River near Noti shows a high flow of 6990 cfs in December 1955 and a low flow of .04 cfs in August of 1977. Monthly stream flows from year to year are not this varied but there are large differences depending on the weather that year - some years are very wet while others quite dry.

LOW FLOWS - The effects of clear cut logging on water yield have been well studied. In almost all cases there is an increase in low flows following clear cutting of forest (Rothacher 1970; Harr, R. D. 1972). In the forest standing trees intercept some of the rainfall that later evaporates after the rainfall stops, reducing the amount of water available for runoff. The largest impact is from transpiration - trees take up water and pass it through there needles or leaves. The roots of trees penetrate well below the area affected by evaporation alone and, therefore, remove more water from the soil than would otherwise leave. In some rare cases where fog drip produces large amounts of annual precipitation there was a decrease in flows after logging (Harr 1982), but this is not the case in this watershed so a reduction in vegetation would cause an increase in flows. Most of this increase occurs during the wet period, about 80 percent, with the remainder coming in spring and summer (J. Rothacher 1970). As vegetation grows back these increases disappear to prelogging flows.

PEAK FLOWS - A peak flow is any deviation from base flow; these can occur during a summer drought, if a rainstorm occurs that causes any temporary increase in stream flows. High flows are a natural occurrence in Oregon Coast Range streams. They most often occur in the winter months, particularly December and January. Peak stream flows may be affected by logging and road building. The extent to which they are affected depends on many things including the size of storm that caused the peak flow.

Trees remove water from the soil and release it into the atmosphere, thus drying the soil more completely through the growing season. When the early rains come in the fall more of the water is stored as soil moisture and less is available for runoff, causing lower stream flows. As the winter progresses trees are not actively transpiring water so this is not a factor in later storms. Trees also affect the water available for runoff by intercepting the rain that is later evaporated. Conifer needles have a large amount of surface area for their volume and stay on the tree all year making them very efficient at intercepting rain. In small storms interception can have a large impact on the amount of water available for runoff. For example, if .2 inches of rain were intercepted from a 1 inch storm, it would show a much greater difference than if .2 inches were intercepted from a storm of 4 inches. In larger storms interception is not as much of a factor.

Although the evidence is not conclusive, in some cases it may be possible for roads to cause an increase in peak flows (Wemple, Jones, and Grant 1996). If a large percentage of the road system is midslope road, and if the road drainage system is hydrologically connected to the stream network, it can create an increase in the drainage density of the hydrologic system, thus decreasing the time it takes for storm flow to reach the main channel. If this flow is synchronized with flow from other drainages it would cause an increase in the downstream peak flow. If it were not synchronized it would not have an effect. In studies where roads did appear to make a difference they were extensively connected. For example Jones and Grant (1996) found an increase in flows when 57 percent of the roads were connected to the streams. Harr in 1976 reported an increase when 12 percent of the surface area was in roads, which is an unusually large amount. However, only 12 percent of the roads in this watershed are connected so they are not a major concern.

RAIN-ON-SNOW (ROS) - Another possible influence on peak flows is the rain-on-snow condition. This occurs where a warm snow falls and is intercepted by the branches of large trees. Since this snow has more surface area than snow in a clear cut, more of it is able to melt if it warms during the storm. If a warm snow storm persists, a difference in accumulation can build up with the snow much more shallow under the timber than in the open. The next component of the rain-on-snow effect is the process by which the snow melts. If the snow storms are followed by a warm windstorm, the snow will be melted by the temperature of the air and the latent heat from the condensation of the water vapor in the moist air, and by the warm rain. The importance of the wind is to keep exchanging the air at the surface of the snow - the greater the exchange, the faster the snow melts. As the stands grow back this air exchange becomes less efficient, thus lessening the effect. ROS is not a very common occurrence in the Coast Range. Berris and Harr (1987) reported the rain-on-snow zone is approximately from 1100 to 3600 feet in elevation for the Oregon Cascades. A local analysis was done by Ken Carlson of Beak Consultants for the Weyerhaeuser Corporation using data from snotel data from local Cascade stations. He determined the dominant rain-on-snow zone was from 2180 feet to 2830 feet in elevation for the eastern portion of the Eugene District. A check on the Internet found no snotel stations in the central Coast Range. This is probably due to the fact that large snowfalls are not common in the Coast Range. The majority of the watershed is under 1000 feet so the chances for a rain-on-snow event are very small.

OVERLAND FLOW - Overland flow is not a concern in the fringe portion of the watershed. According to the Soil Survey of Lane County Area, a majority of the soils in the fringe area are Bellpine, Peavine, and some Digger. The permeability rates of these soils varies from a low of .2 inches to .6 inches per hour for Peavine to a high of 2 inches to 6 inches per hour for Digger. The Bellpine, which is a very common soil in the fringe area, has a rate of .6 to 2 inches per hour. The litter layer and duff layers will also intercept and hold rainfall. The 100-year 6-hour rainfall amounts range from 2.4 to 3.5 inches in a 6-hour period or about .5 inches per hour. Even in this extreme condition overland flow would not be expected in undisturbed soils. If soils were compacted or severely burned this would not be the case.

LARGE WOODY DEBRIS - As is the case in most of the forested portions of the Coast Range, the flood plains of the streams in the fringe area are not wide and do not allow meandering of the streams to much of an extent. Therefore, large woody debris in the channel becomes an important component in the storage of sediments, pool formation, and quality of habitat for fish. Large wood in the channel slows the flow of the stream, allowing gravels and other fine sediments to drop out and remain in the channel. The increase in turbulence increases the re-aeration of water. Large wood can also cause the stream to back up and spill into the flood plain where fine sediments can be deposited. Large woody debris creates areas of variable velocities causing scouring of pools and sorting of sediments. There are no current stream surveys for large woody debris but, considering the current amount of riparian area that has potential to contribute large wood to the streams, it is likely that large wood is not at historical levels. At present only 5 percent of the riparian area within 100 feet of the streams has a high potential to deliver large conifers to the streams, while 82 percent has a low potential. Conifers are the most important source of large wood and, because of their size and longevity in the stream, they have a much more significant impact on the hydrology of the streams than hardwoods.

FISH HABITAT

There are a number of factors that influence the condition of fish habitat in the Long Tom River Watershed including riparian vegetation, channel morphology, peak flow, stream structure, sediment, and water temperature.

Large wood contributes significantly to the health of the aquatic ecosystem of the watershed. Wood traps sediments in the valleys and creates a variety of habitats. Because of the natural lack of large boulders in much of the watershed, large wood and beaver dams are needed to keep channel substrates from being discharged through the stream system. Wood provides a wide range of habitats, stream cover, organic matter to support invertebrate populations, and retention of aquatic habitat as streams meander and change channels. With an adequate supply of large wood, habitats lost through flooding can be quickly reestablished. The relationship between the riparian vegetation and large wood is especially important for continued maintenance of stream structure.

Past management activities in the Long Tom River Watershed have reduced stream structure. There is a lack of adequate structure in the form of large wood throughout much of the watershed, except for parts of some streams. Peak flows are channel changing flows. Well structured streams are better able to withstand peak flows without loss of channel habitat. Adequate structure and riparian vegetation will decrease stream velocity, affecting the deposition of sediments and resulting in a build-up of the flood plain and channel bottom. Stream structure will divert stream flow, which will cause bank cutting and meandering. This may result in the following:

1. Deeper flood plain soils for water storage and plant growth.
2. Raised channels that reach the flood plain more often and transfer water to the riparian area more efficiently.
3. Greater sinuosity that results in more stream/riparian contact, larger riparian areas, and slower velocities.
4. Changes in channel location that create backwaters and other aquatic habitat.
5. More and deeper pools.
6. Disturbance of the riparian area for young seral stage organisms.
7. Higher base flows and less damage from peak flows.
8. More frequent valley flooding and less frequent downstream flooding.

Peak flows affect fish habitat composition of a stream system more than base flows. Because more water is traveling down a stream system at higher velocities, the potential for wood in the stream system to be moved downstream is greater. The duration of a peak flow can be detrimental as large wood is forced farther downstream and eliminated from areas that may need it the most.

If there is no adequate structure in the stream system, many of the riparian/hydrologic functions will be lost. This may result in stream channel and bank instability. When streams are straightened to accommodate roads, there may be increases in stream gradient and confinement, which would increase water velocity and erosion of the channel.

Inadequate culverts, scattered at locations within the watershed, also hinder movements of fish, macro-invertebrates, and amphibians. Some culverts are set at too steep an angle, increasing the velocity of flow and creating forces fish and other aquatic animals cannot negotiate. This is especially true for the smaller, weaker juveniles. Culverts that are too small in diameter also have increased flow velocities and have adverse effects on fish movement. Erosion on the downstream side of culverts can scour the streambed and create a plunge too high for upstream passage. In addition, aging culverts collapse or otherwise fail, which obstructs fish passage.

Water temperature, specifically maximum summer temperature, can adversely affect salmonids in many ways. Direct mortality occurs if temperatures are too high; diseases increase dramatically in warmer temperatures; eggs and fry will not develop in warm waters; and adults will not migrate up streams if the temperature is too high.

Deep pools help mitigate the effects of high water temperatures. Cooler water sinks while warmer water rises. The bottoms of deep pools have lower stream velocity than in the main channel, so the cooler water tends to stay uncirculated with the faster, warmer water above. These cool deep pools are often critical to the survival of some aquatic species. Usually more groundwater interchange in deeper pools helps keep temperatures lower.

The initial temperature of stream water is determined by the elevation where the water reaches the surface of the ground. Groundwater temperature is generally considered similar to the average annual air temperature. Water temperature in streams almost always increases as the water flows downstream and picks up energy. The vast majority of energy that warms the water is from direct solar radiation. The factor that has the greatest effect on maintaining water temperature is shade from direct solar radiation. Most shade is provided by riparian vegetation, although topography, distant tall trees, and dead material provide some shade. Many of the streams appear to be adequately shaded by vegetation, although parts of Long Tom River and some tributaries need more shade.

Soil erosion introduces fine sediments into the stream and may inhibit proper fish egg development. Additionally, spawning gravel may become imbedded with finer sediments causing the gravel to become unusable for spawning, depending on the rate at which those finer materials are introduced and flushed from the system. Stream bank erosion occurs along parts of Long Tom River and other streams in the watershed, especially where vegetation is insufficient for bank protection.

The porous, cohesionless soils of the Coast Range have very high infiltration rates and high permeability. This, in conjunction with organic matter, results in the rare occurrence of overland flow. Subsequently, sheet, rill, and gully erosion are rare. For these types of erosion to occur, the soil would have to be bare and compacted, such as found on dirt roads and logging skid trails.

RECREATION

What are the recreational demands for this watershed, and can BLM provide facilities to accommodate them?

1. **Valley fringe (BLM lands)** - There has been little public demand on BLM to develop recreational facilities in this watershed outside of a motorcycle club. Most of the dispersed activities that occur in this watershed, such as hunting and driving for pleasure, do not require facilities. This motorcycle group has been asking and wanting to work with BLM on designating a trail system with staging sites in the Low Pass area. As stated previously, BLM started a process to meet this demand by coordinating with the motorcycle group and the private landowners in the Low Pass area.

2. **Eugene Wetlands Site** - Recreational activities are limited to those that are compatible with the wetland site, such as hiking, watching wildlife, and photography. Public demand was expressed for a photo blind at the Steward Pond site and one was built by BLM. Equestrian use is restricted to one local area where BLM provides access to the banks of Amazon Creek, which is controlled by the City of Eugene. BLM participates in an environmental education working group that includes local school districts, the City of Eugene, and Lane County Audubon. The goal of this group is to establish a Wetlands Environmental Education Center.

Are recreational activities creating any conflicts and, if so, what are they?

1. Valley Fringe (BLM lands)

Conflicts have arisen between motorcycle users and private landowners. BLM started coordinating between one organized motorcycle group and private landowners in the Low Pass area. The result of this effort has stalled due to various reasons. The State has also identified party areas regarding campfires that escape control.

In addition, the existing Low Pass trail system is within Late- Successional Reserve (LSR) lands. Trail riding has been long established in this area, but being in LSR lands raises questions in regard to conflicts with wildlife issues.

Another resource conflict within the Low Pass area and botany resources is that meadow knapweed or *Centaurea pratensis*, a nonnative invasive plant species could be spreading by OHV activity as well as other sources.

2. Eugene Wetlands

Open wetland fields close to town are a temptation for easy access for recreational activities that have not been compatible with preserving the natural habitat. An example would be a BMX bike jump, created by energetic youths shoveling dirt, was discovered in a meadow one year. The area has since been restored to its natural state. Another example is OHV activity that has been banned within the wetland boundaries, but some activity still occurs.

Equestrian activity could be in conflict with botanical resources as invasive and nonnative plant species may be spread by their presence if precautions are not taken. In addition, equestrian use will be in conflict with restoration work in 1999 when the Amazon levees south of Royal Ave are removed and no longer available for trail use.

Another issue of hunting is allowed outside the City limits in some wetland areas. This could create public use/safety conflicts in some areas such as where the Fern Ridge Bike Path is planned for extension beyond the City limits, but is still within the wetland boundary.

LAW ENFORCEMENT ISSUES

What types of illegal activity are occurring in the watershed, and what management practices can be implemented to prevent or reduce them?

1. Valley Fringe (BLM lands)

Garbage dumping is one of the major activities occurring on BLM lands. When a dump site is found, it is cleaned up as soon as possible. If evidence is found to indicate the owner, that person is contacted to do the cleanup, otherwise BLM personnel usually do the work. Besides garbage dumping, sometimes hazardous waste dumping also occurs usually involving "meth" by-products. When a meth site is discovered, special cleanup crews are called on to cleanup the site. Poaching as well as illegal firewood cutting are activities that have occurred on BLM lands. Increasing BLM presence through law enforcement patrols could help in deterring these activities. Currently, the Eugene District has only two active rangers.

2. Eugene Wetlands

Several types of illegal activity have occurred at the wetland site. Abandoned campsites with trash, hidden in the brush, have been discovered and cleaned up. Regular trash dumping, vandalism to signs, and camping trespass also occur. Cleaning up these sites as soon as they are discovered protects the land values. Replacing or repairing signs immediately helps in preventing further damage as well as keeping the site looking well maintained. Moving trespassers (such as campers) off the land again protects the land from becoming a garbage dump. Another problem is off-highway vehicle (OHV) use on protected and restored wetlands. Past damage has been done by 4-wheel drive vehicles. Strategic placement of gates and barriers and related signage has reduced this inappropriate use.

WILDLIFE

Ecosystem processes mold the structure and composition of vegetation and, in turn, wildlife abundance, distribution, and species composition. In recent years many ecosystem processes have been curtailed or altered due primarily to human influence. As a result, present conditions of vegetation in the Valley Fringe of the Long Tom Watershed bear little resemblance to past conditions, and it is not surprising that the composition of the wildlife component has changed a great deal as well.

Disturbance Processes, Results, and Interrelationships

Mature Forest Habitat and Associated Species - Ecological processes as described in the ROD (USDA/USDI 1994) shape mature and older forest habitats. The resulting conditions such as structural complexity, snags/CWD, long intervals between disturbances, and large patch size create a habitat that is exploited and to some degree sustained by a large suite of wildlife species. These species convert living and dead wood into woody debris, accelerate the decay process, create niches for other species to exploit, and transport nutrients and seeds.

Many older forest species now carry special designations, and their population stability is a reflection of the functionality of the remainder of this habitat. These species include: bald eagle, northern spotted owl, marbled murrelet, Siskiyou chloealtis grasshopper, Roth's blind carabid beetle, variegated salamander, northern goshawk, long-eared myotis, fringed myotis, long-legged myotis, Yuma myotis, Pacific western big-eared bat, white-footed vole, Oregon megomphix, blue-gray tail-dropper, papillose tail-dropper, red tree vole, true-fir pinalitus, Douglas-fir platylygus, clouded salamander, pileated woodpecker, and American marten.

PROCESSES

- ***Timber harvest has replaced fire as the dominant large scale disturbance.***

  Results - decreased late-successional patch size, increased fragmentation, reductions in remnant green trees, snags, coarse woody debris, etc., and reductions in remnant late-successional patches within disturbance areas.

  Interrelationships - changes in wildlife species composition, favoring edge species, early to mid-seral species, and habitat generalists while reducing opportunity for late-successional dependent species.

- ***Approximately 84% of the coniferous forest (17,179 acres) are less than 80 years old and the product of same-age single-species plantation management, (1998 FOI data).***

  Results - A lack of tree species diversity, structural heterogeneity, remnant material, variable regeneration rates, and natural thinning from wind, fire, disease etc.

  Interrelationships - A closed canopy and homogenous structure reduces species' richness. These stands tend to have few interior wildlife species and lack the structural components to support rare elements such as the northern spotted owl or marbled murrelet.

- ***Patch sizes have decreased from large (greater than 1,000 acres) to small (24.5 acres; range 3.4 to 150 acres) for late-successional habitats***

  Results - Many small patches vs. few large patches, large amounts of well defined edge, greater distance between similar patches.

  Interrelationships - Late-successional dependent species with large home ranges must cross unsuitable areas and travel farther to locate suitable habitat. Late-successional species with low mobility and small home ranges become isolated and susceptible to stochastic and human-caused disturbances. Higher risk of local extinctions.

- ***The pattern of forested land conversion to younger stands, brush fields, agriculture, and subdivisions, as well as heavy dissection by roads, does not resemble the historical pattern.***

  Results - Increased fragmentation and reduced availability of interior habitat.

  Interrelationships - Less availability of high quality suitable habitat for wildlife species that depend on interior characteristics. Increases in competition, parasitism, predations from exotics and non-interior or edge species. A concurrent increase in abundance of edge-adapted species and open/shrubby habitat exploiters occurred.

- ***Ecosystem function becomes a scientific and public concern based on the results of rapid forest harvest/modification.***

  Results - New District management direction via the ROD/RMP (1994), additional species protection via the Endangered Species Act, and great scrutiny of activities by agencies and public interest groups.

  Interrelationships - Designation of LSRs and Connectivity Blocks as well as other habitat set aside areas to protect remaining older forest habitats and create old forest stands in the future. Special designations for many dependent wildlife species.

Riparian Habitat and Associated Species

These areas provide important linkage habitat, moist soil environments, and unique structural components not found in the upland environment.

As a result of the modification of riparian areas within this and other watersheds, there are several wildlife species that experienced a reduction in habitat availability. These species include: Vertree's ochrotrichian micro-caddisfly, Siskiyou caddisfly, tailed frog, northern red-legged frog, foothill yellow-legged frog, variegated salamander, Western pond turtle, Mulsant's water-treader, Alsea ochrotrichian micro-caddisfly, Corvallis diving beetle, Fender's rhyacophilan caddisfly, and Montane bog dragonfly.

PROCESSES

- ***Disturbances such as occasional floods and landslides have been replaced by frequent timber harvest, road construction, and agricultural practices within and along riparian areas for the majority of streams in the Valley Fringe.***

  Results - Widespread fragmentation of stream corridors and riparian habitat, isolation of remnant habitats, changes in temperature, and vegetation structure and composition. Increased sedimentation and frequency of landslides.

  Interrelationships - Reduction in the ability of riparian areas to provide micro-climates and other habitat conditions for dependent wildlife species. Allows increased competition from nonnative, and edge-adapted species.

- ***Conifer-dominated riparian has converted to deciduous-dominated riparian.***

  Results - Isolated pockets of coniferous riparian. Loss of coarse woody debris. Changes in understory species structure and composition. Extended deciduous stages and difficulty reestablishing conifers.

  Interrelationships - conversion has created wider barriers to movement between isolated conifer riparian. Loss of physical structure (logs, debris jams) that formerly allowed less mobile species to cross larger rivers and streams are no longer as available, further reducing movements.

- ***Beavers are no longer a driving factor in stream/riparian structure and function.***

  Results - Loss of wet soil habitats, wet meadow/willow communities, browsing disturbance to hardwoods, wood recruitment into streams, biotic transfer, and ponded water. Water is transported through the system at a greater rate, reducing soil saturation time. Water tables can lower and the riparian influence is narrowed.

  Interrelationships - Beaver are a keystone species that have the ability to create habitat on which many other species depend. Opportunity for these species is now limited to human-made ponded sites and isolated areas functioning secondarily as habitat. These sites are often off BLM land and used primarily for agriculture or housing. These species are then at risk of additional human impacts such as pesticide use, drainage, and complete site conversion.

Grassland Associated Species - The valley bottom portion of this watershed is characterized by wet meadows and grasslands interspersed with hardwood and coniferous woodlands. Many species that were associated with the grasslands and wet meadows are now considered rare to this area. These species include: Fender's blue butterfly, American acertropis grass bug, Taylor's checkerspot, and Marsh carabid beetle.

PROCESSES

- ***Valley bottom grasslands have been converted to urban development, agriculture, and introduced species.***

  Results - Small, isolated remnant grassland patches exist within a matrix of completely altered habitat. Functionality is questionable due to size and infestation with nonnative species.

  Interrelationships - Isolation from other patches is greatly increased. For some species isolation is complete while for others (some winged creatures) it may only be partial. Genetic transfer is slowed down or curtailed completely. Species dependent on unique components become vulnerable and local extinctions are high.

- ***Processes such as periodic fires and flooding have been suppressed or curtailed.***

  Results - Fire dependent species become less abundant. Nutrient conversion and transport is slowed down. Exotic species have opportunity to establish. Successional advancement converts grasslands to shrub lands. Community composition may become richer but lose unique components.

Interrelationships - Wildlife species dependent on fire or plant species that require fire now have limited opportunities. Shrub species can become more abundant and reduce the grassland character, ultimately attracting an entirely different suite of wildlife species.

Generalist Habitats - Some species, such as large mammals and wide ranging predators, require specific characteristics and habitat components within several habitat types. These species are opportunistic in regard to exploiting the results of habitat changes and disturbances for forage or prey while often selecting more stable long-lasting habitats for denning or bearing young.

PROCESSES

- ***Good accessibility to forage and browse vegetation has shifted from valley bottoms and forest openings to recent clear cuts.***

  Results - Elk and deer movements and activity centers have redistributed from historic patterns.

  Interrelationships - Human activities, primarily hunting patterns, are now the factor that determines elk and deer distribution within the habitat. Other factors that affect their movements are human activity patterns, travel patterns, roads, settlements, and logging operations. At a finer scale and to a lesser degree, the cover/forage ratio and matrix influences habitat use.

  Large predators such as cougars follow prey movements so they have redistributed as well.

BOTANY

Fire was historically an important process in maintaining native Willamette Valley and forest fringe plant communities. Because of fire suppression and a concomitant succession of grassland communities to forested habitats, many native Willamette Valley ecosystems are now close to extinction (Christy and Alverson 1994). It is thought that forest stand gap dynamics (including windthrow, fire, disease) are important to the location and maintenance of populations of wayside aster (*Aster vialis*) and tall bugbane (*Cimicifuga elata*), two Bureau Sensitive vascular plants (Conservation Strategy Cimicifuga elata 1996; Wogen 1998). Fire and other soil disturbance is thought to be an important ecosystem process in the maintenance of branching Montia (*Montia diffusa* - a BLM Tracking vascular plant species) populations across the landscape. Current forest practices have all but excluded the use of prescribed and natural fires from our forest landscapes. Riparian fluvial processes are important in the location and maintenance of populations of loose-flowered bluegrass (*Poa laxiflora*), a Bureau Tracking vascular plant species. Ecosystem dynamics and processes have also been important in the development and maintenance of special habitat features and overall landscape biodiversity. Careful management prescriptions to mimic ecosystem processes will be needed to maintain some Special Status Plant (SSP) species, special habitats, and overall biodiversity across the Long Tom landscape.

Groups of nonvascular species including lichens, fungi, and bryophyte species were listed in the Northwest Forest Plan (1995) to warrant special consideration. These species were termed Protection Buffer (PB) and Survey and Manage (S&M) and were generally thought to be species dependent upon old growth forest ecosystem within the range of the northern spotted owl. These PB and S&M species as well as all lichens, fungi, and bryophytes are important components in the overall diversity of northwestern forests. Old growth forests are thought to contain a greater productivity and diversity of vascular and nonvascular plant species.

Although there are no direct impacts of noxious weeds on any known SSP, PB, or S&M plants in the Long Tom Watershed, noxious and other nonnative species have the potential for competing and displacing native species, ultimately leading to changes in plant communities and ecosystem functioning. Road construction and seeding with nonnative seed mixtures exacerbate the entry and spread of noxious and nonnative species. Because there is little interest in the maintenance of native plant communities on private lands, and because private lands will be producing most early seral habitats in the future, this interaction may be especially important in the displacement of native, early seral plant species. Our next rare species might be early seral species that are competitively excluded from their historical native habitats.

Older forests have been documented to have a greater productivity and diversity of lichens and bryophytes (Rosentreter 1995; Peck and McCune 1997; Rambo 1997; Rambo and Muir 1998). In particular, older forest may have greater quantities of cyanolichens (nitrogen fixers) that drop to the forest floor during natural processes and high wind events (Sillett and Neitlich 1996) These organisms then become available as a food source to terrestrial animals or are recycled to the forest floor, and thus may be important to long-term soil fertility of stands.

Lichen species are generally thought to be very dispersal limited (they do not disperse propagules very far from their point of origin; Neitlich and McCune 1995). Because of past timber cutting levels and landscape fragmentation, the current distribution of many lichen species may be much reduced from historical levels. Management practices to enhance dispersal may be needed to ameliorate past practices. New management practices may be as simple as selecting leave trees in harvest regeneration units with good populations of dispersal-limited lichens at high points in the landscape (on ridges) to assist in landscape dispersal. The BLM role may be especially important given the checkerboard ownership of this landscape and on private lands the likely abolition of population points (e.g., "legacy"or old trees) to reestablish and distribute from.

Management of wildlife is directed through the management of vegetation and forest structure. Available vegetation and structure determine whether habitat is available for specific wildlife species. Important functions of vegetation include use as direct or indirect (food for the prey base) forage, cover, nesting, etc. Classic and recent examples of this dependency include: the importance of early seral plant species for deer and elk forage and importance of older stands for winter cover; importance of large bryophyte-covered limbs (particularly affected by mistletoe induced branching) for marbled murrelet nesting sites; and the interrelationship of forest truffles as an important food source for the northern flying squirrel (important in the dispersal of the truffle propagules), which in turn is an important food source for the northern spotted owl. Both fungi and lichen species are thought to be important components in the diets of invertebrates and small mammals, which act to further distribute these species across the landscape. These invertebrates

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and small mammals also serve as a prey base for species at higher levels on the food chain. Thus, the concept of a "web" of community interactions has developed.

Fungi are also important in the development of appropriate forest structure for wildlife habitat. For example, fungal infections in some trees facilitate snag and cavity development. Fungi are also important in development of forest gaps for plant species and habitat diversity.

Maintenance of Coarse Woody Debris (CWD) across the landscape and in a variety of decay classes may be very important in the temporal and spatial maintenance of fungal, lichen, and bryophyte diversity. Some species may be very specific to particular decay classes of CWD, so maintaining a variety of decay classes that are distributed across the landscape will help to maintain a continuity of substrates in time and space for various species habitat.

Due to past forest management practices, the distribution of hardwood and minor conifer tree species may be more restricted, particularly in upland locations, and perhaps more expansive for hardwoods in riparian zones than were historically present. Hardwood trees are particularly important to the diversity and distribution of epiphytic bryophytes and lichens (and potentially there are closely associated fungi) across the landscape (Rambo 1997; Rambo and Muir 1998).

VEGETATION

Past and Current Vegetation Patterns Within the Watershed and Disturbances that Contributed to Vegetation Conditions Within the Watershed

Vegetation Condition and Pattern - The vegetation pattern has changed considerably within the Long Tom Watershed from the 1850s to the present. The past and current (1997) vegetation patterns and the current vegetation class distribution within the watershed are described in detail in Chapter 3 and Appendix C - Vegetation. (Also see the vegetation maps - early historic to present - in the map packet.)

The Long Tom valley fringe analysis area has shifted from a predominantly older forest of large patch size to a current condition predominantly young in age and highly fragmented in respect to the distribution of trees among the various vegetation classes. The current vegetation pattern reflects years of intensive forest management, fire suppression, and the checkerboard land ownership pattern within the watershed that have masked natural disturbances (wind and fire) and anthropogenic fire disturbance as the major influences of vegetation pattern. The patch size of vegetation within the watershed has decreased over time to an overall average patch of only 37 acres in 1997 (based on GIS data).

This shift in vegetation patterns to younger more fragmented forest has resulted in a shift of terrestrial wildlife species favored and has resulted in changes to the functioning of riparian systems. These relationships are addressed within the wildlife and fisheries sections of the analysis.

With consideration for these current conditions of the forested landscape the *Northwest Forest*

Plan has allocated the landscape with corresponding resource objectives and goals (developed land use allocations) to address the needs of all species within the forested landscape. These land use allocations within the Long Tom Watershed are the Matrix (GFMA and Connectivity), Late-Successional Reserves (LSR), and Riparian Reserves. The vegetation characteristics (vegetation class distributions) within these land use allocations (LUAs) are listed in Table C-3 of the Appendix C. The management of the Matrix, LSR, and Riparian Reserves is discussed below. Further management criteria for these land use allocations can be found in the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl* and *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl,* April 1994; the *Eugene District Record of Decision and Resource Management Plan, June 1995*; and the *Late-Successional Reserve Assessment, Oregon Coast Province -Southern Portion- (R0267, R0268)*, June 1997.

Current Vegetation Characteristics of the Matrix (GFMA and Connectivity) Within the Watershed and Management of the Matrix for Commodities Given Other Resource Objectives

MATRIX LAND USE ALLOCATION

The Matrix land use allocation includes both Connectivity /Diversity Blocks and General Forest Management Areas (GFMA). (The Riparian Reserve overlaps these management areas and is discussed later within the chapter.) There are approximately 12,504 acres of the BLM administered Matrix land use allocation within the Long Tom valley fringe (approximately 10,542 acres of GFMA and approximately 1,962 acres of Connectivity). Additional isolated land parcels of Matrix lands are located within the Long Tom Watershed outside of the valley fringe analysis area. The Matrix land use allocation makes up approximately 13 percent of the Long Tom valley fringe and approximately 62 percent of the BLM ownership within the valley fringe. The management objectives for the Matrix include the following:

- Produce a sustainable supply of timber and other forest commodities to provide jobs and contribute to community stability.
- Provide connectivity (along with other allocations such as Riparian Reserves) between Late-Successional Reserves.
- Provide habitat for a variety of organisms associated with both late-successional and younger forests.
- Provide important ecological functions, such as dispersal of organisms, the carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components, such as down logs, snags, and large trees.
- Provide early-successional habitat.

GENERAL FOREST MANAGEMENT AREA (GFMA)

Scheduled harvest will occur within General Forest Management Areas (GFMA). Silvicultural systems in the GFMA will be designed to promote production of merchantable timber, while retaining some larger trees and snags, and maintaining forest health and productivity. Needed management actions will consist of 6 general types of silvicultural treatments to accomplish these objectives:

- regeneration harvest with partial retention;
- site preparation following harvest;
- reforestation treatments;
- management of young stands;
- commercial thinning in mid-aged stands; and
- management of overstory trees, snags, and large woody debris.

These treatments and other management opportunities are also discussed in Chapter 5, Management Opportunities.

Current FOI data shows approximately 26 percent of the BLM forested acres within the GFMA are in the 0, 10, and 20 year age classes. Approximately 64 percent of the BLM forested acres within the GFMA are in the merchantable 30-70 year age classes, and approximately 10 percent of the BLM forested acres within the GFMA of the Long Tom Watershed are late-successional (≥80 years of age). All of this late-successional habitat within the GFMA would be deferred from regeneration harvest to meet the 15 percent late-successional habitat requirement for the watershed. (See paragraph addressing the 15% requirement.)

Any management actions within the GFMA must also integrate the special management criteria required for other reserve and management designations. These reserve and management designations include approximately a 129 acre Supplemental Reserve Habitat site located within the GFMA; approximately 170 acres of Rural Interface Area; approximately 279 acres of Special Recreation Management Areas (Upper and Lower Lake Creek SRMAs); a progeny test site of approximately 18 acres (Ferguson Progeny Site); 150 acres of the Lorane Ponderosa Pine Potential Area of Critical Environmental Concern (ACEC); and known sensitive plant sites. There are no known cultural resource localities within any of the GFMA land use allocation. Approximately 46 percent of the GFMA is within Riparian Reserves as modeled in GIS.

CONNECTIVITY

Silvicultural systems in the Connectivity/Diversity blocks will be designed to promote development of late-successional forest structure within a longer rotation, while providing an output of merchantable timber and maintaining forest health and productivity. Lands available for harvest will be managed generally as even-aged stands with substantial overstories of larger trees. Needed management actions will consist of 6 general types of silvicultural treatments to accomplish these objectives:

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- regeneration harvest with partial retention;
- site preparation following harvest;
- reforestation treatments;
- management of young stands;
- density management thinning in mid-aged stands; and
- management of overstory trees, snags, and large woody debris.

These treatments and other management opportunities are also discussed in Chapter 5, Management Opportunities.

Connectivity/Diversity Blocks will be managed to maintain 25-30 percent of each block in late-successional forest at any time. The percentage of habitat will include habitat in other land use allocations, such as Riparian Reserves Blocks that may be comprised of contiguous or noncontiguous BLM administered land. To the extent possible, the size and arrangement of forest habitat within a block should provide effective dispersal habitat for late-successional species.

Connectivity/Diversity Block standards or guidelines will be managed for 150 year area control rotations. The plan is to regeneration harvest at a rate of approximately 1/15th of the available acres in the connectivity part of the Sustained Yield Unit (Siuslaw SYU) per decade. Because of the limited size of operable acres within any given block, multiple decades of harvest could be removed at any one time from a single block in order to make viable harvest units. (See the plan maintenance document concerning the issue of area control rotation of Connectivity/Diversity Blocks, June 1997 included within the Vegetation Appendix C of this analysis.)

Stands approximately 30-110 years of age can be considered for density management thinnings. Density management may include one or more of the following objectives:

- to accelerate growth of trees that would later provide large-diameter snags and down logs;
- to promote development of understory vegetation and multiple canopy layers;
- to produce larger, more valuable logs;
- to harvest mortality of small trees as the stand develops;
- to maintain good crown ratios and stable, wind firm trees; and
- to manage species composition.

Based on Forest Operations Inventory (FOI) data, the Siuslaw SYU has an estimated 14,020 acres in Connectivity of which 13,490 acres are forested. There are approximately 2,040 gross acres of Connectivity within the Long Tom Watershed of which an estimated 1,969 acres are forested (FOI data).

Current FOI data shows approximately 43 percent of the BLM forested acres within the Connectivity are in the 0, 10, and 20 year age classes. Approximately 25 percent of the BLM forested acres within the Connectivity are in the merchantable 30-60 year age classes, and approximately 32 percent of the BLM forested acres within the Connectivity land use allocation within the Long Tom Watershed are late-successional (≥80 years of age). All of this late-successional habitat within the Connectivity would be deferred from regeneration harvest to meet the 15 percent late-successional habitat requirement for the watershed. (See paragraph addressing the 15% requirement.)

Any management actions within the Connectivity must also integrate the special management criteria required for other reserve and management designations within the Connectivity land use allocation. These reserve and management designations include approximately 107 acres of Rural Interface Area; approximately 160 acres of the Fox Hollow Research Natural Area Withdrawal; and known sensitive plant sites. There are no known cultural resource localities within the Connectivity land use allocation. Approximately 67 percent of the Connectivity of the watershed is within Riparian Reserves as modeled in GIS.

THE 15% RETENTION REQUIREMENT - RETENTION OF LATE-SUCCESSIONAL FOREST

The 15% Retention Standard and Guideline (S&G) is designed to retain and protect ecologically significant forest stands, patches, and fragments that provide biological and structural diversity to function as refugia for old growth associated species in watersheds where little late-successional forests remains. Benefitting from this mitigation are the full array of species identified in Appendix J-2 of the Final Supplemental Environmental Impact Statement (FSEIS 1994).

The current 1998 Forest Operations Inventory (FOI) data indicates that approximately 16 percent of the Federal (BLM) forested acres within the Long Tom Watershed are currently in a late-successional (≥80 years of age) condition of which approximately 14 percent are located in reserves. The remaining 2 percent of these late-successional forested acres are located within the upland Matrix. Regeneration harvest of this remaining 2 percent of late-successional forest within the upland Matrix of the watershed will be deferred until additional late-successional forested acres become available within the reserves or another assessment of late-successional habitat for the watershed is completed. (Refer to BLM-Instruction Memorandum No. OR-98-100 dated September 14, 1998 and Regional Ecosystem Office (REO) Memorandum to Regional Executives dated October 24, 1997).

Current Vegetation Characteristics Adjacent to the Streams Within the Watershed and the Potential Sources for Large In-stream Structure Based on Current Streamside Vegetation Conditions

Riparian areas play a major role in protecting aquatic systems by shading the stream channel, controlling water runoff, providing bank stability, reducing sedimentation, controlling nutrient flows, and providing habitat and connectivity corridors for plants and animals. Large conifers within the riparian are a source of large woody material, which is a critical structural component of aquatic ecosystems in the Long Tom Watershed. Ninety percent of the woody material that falls into a stream comes from within 100 feet of the stream (McDade et al. 1989).

Large woody material in streams influence channel morphology, particularly by affecting pool formation. Downstream transport of sediment and organic matter is controlled in part by storage behind accumulations of large woody debris within the stream channel. Large woody debris affects the formation of aquatic habitat by providing cover and habitat complexity, and acts as a substrate for biological activity. Adequate structure and riparian vegetation will decrease stream velocity.

Most of the riparian areas in the Long Tom fringe area do not provide an adequate source of large woody debris. Conifers are the best source of woody debris because they grow to be larger trees and, once in the stream channel, do not decay as quickly as hardwoods. The riparian areas within the Long Tom valley fringe generally consist of young to intermediate aged hardwood forest communities with relatively small isolated conifer forest patches that have the potential for contributing large woody debris to the stream system. Past management practices in the Long Tom valley fringe, including timber harvest and removal of large woody debris from stream channels, have resulted in inadequate accumulations of large woody debris for a proper functioning aquatic ecosystem.

Approximately **82 percent** of the streamside vegetation within the Long Tom valley fringe was rated as having a low potential to provide large woody material to the stream channels. Clear cuts, sapling pole, pole young, hardwoods, and nonforest vegetation classifications were all given a **low potential** rating for providing large woody material.

Approximately **13 percent** of the streamside vegetation was rated as having moderate potential to provide large woody material. The streamside vegetation rated as **moderate potential** included the mature over young, old over young, and mixed conifer hardwood vegetation classes.

Only **5 percent** of the streamside vegetation was rated as having a **high potential** to provide large woody material. Most of the high rated streamside vegetation was associated with older stands (mature and old forest vegetation classes) within the riparian area of the upper tributaries (see Coarse Woody Debris Potential Map). Hardwoods and mixed conifer hardwoods accounted for approximately 29 percent of the streamside overstory vegetation within the valley fringe area.

Current Vegetation Characteristics of the Riparian Reserve Within the Watershed and Management of the Riparian Reserve for Aquatic Objectives and Connectivity

RIPARIAN RESERVES

The Riparian Reserves have no scheduled harvest and are to be managed to promote late-successional forest characteristics and to meet the Aquatic Conservation Strategy (ACS) Objectives under the ROD. Some commodities may be produced while managing forest stand structure and forest stand densities for wildlife and aquatic resource objectives within the Riparian Reserve.

Riparian Reserves are recognized as a major factor in achieving the ACS objectives. Understanding the function of and processes occurring in riparian areas is important to ensure that future actions comply with the standards and guidelines for Riparian Reserves in the Northwest Forest Plan and the District ROD/RMP, 1995. As the Riparian Reserves age and mature into late-successional habitat they will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent nonfish species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat. Appendix Table C-4 summarizes the amount of Riparian Reserve by each of the major LUAs for all forested BLM lands. Approximately 46 percent of the General Forest Management LUA, approximately 67 percent of the Connectivity, and approximately 45 percent of the Late-Successional Reserve are to be managed as Riparian Reserve (estimate based on updated GIS hydrological theme, 1998).

Appendix Table C-5 summarizes the acres of each vegetation class (Thrailkill vegetation data) within the Riparian Reserves on BLM lands and all lands within the Long Tom valley fringe. Approximately 19 percent of the Riparian Reserve is currently hardwoods, approximately 6 percent is mixed conifer hardwood, and another approximately 50 percent of the Riparian Reserve within the watershed is currently in younger age classes less than 80 years of age (i.e., clear cut, sapling pole, and pole-young using Thrailkill vegetation data). Because of previous efforts to create stands with maximum wood production, many of these young stands are more uniform and have higher densities than found in natural stands. Without density management, these stands within the Riparian Reserve are at risk of slowing down in growth, having less understory diversity, and less structural diversity than natural stands. Silvicultural practices within Riparian Reserves such as precommercial thinning, density management, underplanting, and establishment of conifers within hardwood areas could accelerate the development of late-successional habitat, large trees for future sources of large snags, and large woody material for both riparian and instream habitat, and understory and structural diversity for a variety of late-successional dependent species. These practices are discussed further in Chapter V, Management Opportunities.

Current Vegetation Characteristics of the Late-Successional Reserve Within the Watershed and the LSR Assessment Objectives of Expanding Existing Large Blocks of Late-Successional Habitat Within the LSR (To Increase Interior Habitat and Connect These Large Blocks to Best Provide for Connectivity of Late-Successional Species).

LATE-SUCCESSIONAL RESERVES

The Late-Successional Reserves have no scheduled harvest and are to be managed to promote late-successional forest characteristics and habitat. Some commodities may be produced while managing forest stand structure and forest stand densities for wildlife and aquatic resource objectives within the LSR.

Landscape Function of the Reserves - Within the context of the landscape, a network of Late-Successional Reserves (LSRs) and Riparian Reserves were designated within the *Northwest Forest Plan* to maintain and enhance late-successional forests habitat for late-successional forest-dependent species. With the implementation of the *Northwest Forest Plan*, there would be an increase in mature and old forest habitat within the watershed over time as stands within the LSRs and Riparian Reserves mature and develop. As the forests within the network of LSRs and Riparian Reserves age and mature toward a late-successional condition, the fragmentation of the vegetation within the watershed would become less pronounced and reduced over time along with an increase in interior forest habitat.

The LSR within the Long Tom Watershed is located primarily in the western fringe of the watershed. The LSR is interspersed in a checkerboard arrangement with private lands that are managed on a shorter forest rotation of 40-60 years. There are 7,838 acres of LSR within the watershed, making up approximately 8 percent of the Long Tom valley fringe analysis area and approximately 38 percent of the BLM ownership within the watershed. Approximately 21 percent of the LSR currently has late-successional habitat (i.e., mature and old forest ≥ 80 years of age using Thrailkill vegetation data). In addition to this habitat there is approximately 10 percent of the LSR in uneven-aged (mature over young and old over young) forest types.

Management of the Late-Successional Reserve - The LSRs within the watershed are a part of the LSR areas R0267 and R0268 for which an LSR assessment was completed in 1997 (*Late-Successional Reserve Assessment, Oregon Coast Province -Southern Portion- R0267, R0268*). This assessment provides criteria for developing appropriate management treatments including a determination of the conditions on the landscape which would trigger management activities (refer to page 34 of the LSR assessment). The LSR assessment identified the need to secure the "best " habitat areas first before devoting limiting funding and resources to more degraded areas. This strategy affirms the aquatic conservation/restoration strategy objectives and priorities developed by the Northwest Forest Plan. The treatment priorities set at the LSR assessment level were based on securing the best habitat first by blocking up large patches and connecting isolated patches.

Within the context of the LSR assessment area (from Newport and the Yaquina River at the north to Reedsport and the Umpqua River at the south); the LSR south of Highway 126 within the Long Tom watershed was identified as part of the Corridor LSR Zone. The Corridor LSR zone serves as refugia for late-successional species that are dispersing from and to adjacent LSRs and was considered an important connector to other LSRs in the East Cascades. The LSR north of Highway 126 within the Long Tom Watershed was identified as part of the Buffer LSR Zone. This zone consists of primarily BLM lands in the central eastern portion of the LSR assessment area and was considered vital for maintaining small patches of late-successional forest habitat. The Buffer zone is important for dispersal of late-successional organisms within the LSR and other portions of the landscape. Both the Corridor and Buffer Zones of the LSR are in fire disturbance regimes that have historically produced variable patch sizes with much more landscape variability in seral conditions than would have been found closer to the coast. (Refer to page 30 of the LSR assessment.)

The management goals given within the LSR assessment (page 31) for both the Corridor and Buffer LSR zones are as follows:

- Improve, create, and maintain connectivity across the landscape.
- Within stands, increase connectivity and dispersal habitat. Priority is on northern spotted owl site centers that do not have good habitat.

For all LSR zones, the primary goals stated within the LSR assessment (page 31) are as follows:

- To maintain and restore habitat to support well-distributed populations of late-successional forest species.

- Maintain high priority fire protection, especially along high use travel corridors and on the mixed ownership areas in the Corridor/Buffer LSR zone designation.
- Land exchanges and changes in land use allocations, i.e., changing some allocations to block up areas, should be considered wherever it assists in attainment of the above goals.

Landscape cells were developed from the LSR zones based on existing conditions and the functional role of that portion of the landscape. These landscape cells are discussed on pages 31-33 of the LSR assessment. The Long Tom Watershed falls within two of these landscape cells, the early seral/corridor (Landscape Cell 5) and the early seral/buffer (Landscape Cell 6). The management goals given within the LSR assessment (page 33) for both Landscape Cells 5 and 6 of the LSR are as follows:

- Maintain dispersal habitat. This is critical habitat that is being used.
- Use low risk silvicultural treatments around T&E locations.
- Treatments should focus on lands that are currently unsuitable habitat within northern spotted owl provincial home ranges (i.e., within 1.5 mile radius of the activity center).

Prioritization of treatment areas was based on securing the best habitat first, blocking up large patches, and connecting isolated patches. The LSR within Landscape Cell 5 in the LSR Corridor Zone south of Highway 126 was given a **Priority 3** for treatment by the assessment team, and Landscape Cell 6 within the LSR Buffer Zone north of Highway 126 was given a **Priority 4** for treatment by the assessment team. An exception to these treatment priority areas can be made in order to meet biological treatment windows of stands throughout the LSR where density management treatments would benefit the attainment of wildlife objectives.

Approximately 53 percent (Thrailkill vegetation data) of the public lands in this watershed that are managed as late-successional forest are conifer stands under 80 years old. Because of previous efforts to create stands with maximum wood production, many of these are more uniform and have higher densities than found in natural stands. Without density management, they are at risk of slow growth rate, less understory diversity, and less overall structural diversity than natural stands. There is also a risk of loss of future stand management opportunities to benefit wildlife and ACS objectives if they are left too long without reducing their densities.

There are approximately 1,644 acres of mature and old growth forest habitat (Thrailkill vegetation data), and approximately 777 acres of mature over young/old over young Douglas-fir habitat (Thrailkill vegetation data) within the watershed. Many of the stands are isolated small blocks in size. The resulting fragmentation reduces the utility of the habitat for many late seral species such as the spotted owl, bald eagle, and marbled murrelet.

Although the tracts of older habitat themselves retain desirable characteristics by virtue of their small size, much or all of the stands are essentially "edge" habitat. This condition results in many early seral species entering the older stands and either competing with or preying upon late seral species of concern. In order to enhance existing late seral habitat, it would be important to protect and improve younger stands that surround these older parcels, particularly the smaller parcels, to reduce habitat fragmentation.

Enhancing the habitat of these older fragmented parcels is of more importance when the stands are travel corridors between larger late-successional stands. These corridors aid in the genetic flow and diversity as species travel from one late-successional stand to another.

Silvicultural practices within the LSR could accelerate tree growth and encourage the development of diverse multicanopied stands with greater understory development for a variety of late-successional dependent species. These practices are discussed further in Chapter V, Management Opportunities.

Other Management Areas Within the LSR - Any management actions within the LSR must also be integrated with special management criteria required for other reserve and management designations overlapping the LSR. These reserve and management designations include 4 Supplemental Reserve Habitat sites (approximately 373 acres total) located within the LSR; approximately 123 acres of Rural Interface Area; approximately 192 acres of Bald Eagle Recovery Areas (BEHA); and known sensitive plant sites. There are no known cultural resource localities within any of the LSR land use allocation. Approximately 45 percent of the LSR is within Riparian Reserves as modeled in GIS.

Dispersed Off Highway Vehicle (OHV) Use Within the LSR - There is currently known Dispersed Off Highway Vehicle (OHV) use concentrated in an area (known as Low Pass) on approximately 5,500 acres of BLM and private lands. Most or all of the federal lands within this dispersed OHV use area is designated as LSR. BLM has attempted to establish a designated riding area and developed staging area to minimize or direct impacts to specific areas. This effort has not been accomplished to date. Impacts on special status species and wildlife habitats would be part of the development of the analysis pursued during the process.

LAND OWNERSHIP PATTERNS

Checkerboard Ownership - The current checkerboard ownership pattern, combined with sometimes mutual and sometimes conflicting resource management objectives between adjacent landowners, can provide opportunities and/or constraints to the management of resources effectively for all species concerned and all landowners concerned (see map Long Tom Watershed Ownership).

Private lands can generally be classified as industrial forest lands, agricultural lands, or small private in-holdings. Many of the industrial forest lands are currently early seral forest stands and are assumed to be managed on a short rotation (40-50 years) into the future. These lands will have an impact on the ability of some late-successional forest species to migrate to adjacent LSRs. However, these same private lands will benefit those species that depend primarily on early seral habitats.

Pattern of Ownership Along Streams - Appendix C, Table C-7 shows the percentage of ownership (private and BLM) for 2 groupings of streams by stream order (1st, 2nd, and 3rd order streams and 4th order and larger streams) within the watershed. Within the Long Tom valley fringe, BLM manages 25.7 percent of the vegetation along 1st, 2nd, and 3rd order streams and only 7.6 percent of the vegetation along 4th order and larger streams within the watershed. Due to this ownership pattern along streams, BLM can best manage the upper smaller reaches of streams within the watershed.

Land ownership and pattern of ownership along the streams within the Long Tom Watershed are constraints affecting BLM's ability to manage aquatic and riparian resources especially along 4th order and larger streams where riparian restoration projects to restore instream structure and habitat could be feasible. Due to the limited BLM ownership along these larger order streams it may be necessary to enter into cooperative agreements both with the public and with private and/or State agencies. Land exchanges are another avenue that could be pursued to strengthen BLM's ability to manage fisheries within the watershed.

Land Ownership Exchanges Adjacent to LSR - Land ownership exchanges or acquisitions of lands should be considered when it would facilitate the ability of the LSR to function. The ROD (C-17) itemizes legitimate reasons for land exchanges providing the benefits are equal or greater to current conditions of the LSR either in area distribution or habitat quality. Strategic points in the Corridor LSR zone (those lands dispersed within the LSR south of Hwy. 126 within the Long Tom Watershed) were given a Priority 2 for land exchanges. Those lands within the Buffer LSR zone (those lands dispersed within the LSR north of Hwy. 126 within the Long Tom Watershed) were given the lowest priority for blocking ownership to benefit the function of the LSR on a landscape scale (refer to page 80 of the LSR assessment for these priorities).

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CHAPTER 5
Management Opportunities

This chapter focuses on highlighting management opportunities that are responsive to addressing the issues previously evaluated throughout this watershed analysis and those that are consistent with the Eugene District Resource Management Plan, Late-Successional Reserve Assessment R0267/R0268, and the Northwest Forest Plan. Based on watershed issues, current conditions, and taking into account past conditions, resource interrelationships, data gaps, and the results of Transportation Management Planning, the opportunities for the Long Tom Watershed are discussed below. A variety of project proposals for watershed restoration, as well as data gap opportunities (inventories) and monitoring, are presented for implementation consideration.

Transportation Management Planning

The Transportation Plan (Appendix D) recommends that approximately 50.52 miles of the approximate 110.23 miles of BLM controlled road in the Long Tom Watershed be closed (46%) to vehicular traffic. These roads are recommended to be decommissioned to a Maintenance Level 1. This would include blocking, water barring, pulling stream culverts, and other actions necessary to stabilize the road over time. This includes 5.29 miles of road already closed to access but requiring inspection to ensure they are properly decommissioned.

The remaining 59.71 miles of BLM roads are recommended to be open with designated Maintenance Levels. (Refer to the "Long Tom Transportation Management Objectives" spreadsheet in Appendix D).

FISH HABITAT

Management opportunities for fish habitat in Long Tom River Watershed streams may include the following proposals based on information that was recorded and reviewed pertaining to fisheries and habitat conditions.

For stream structure improvement, more boulders and logs may be added to provide additional stream cover, rearing pools, side channels, cooler water, and collection of more wood and spawning gravel. Addition of structures to raise water levels also would improve riparian and wetland conditions. Such habitat improvements may be needed in parts of most named streams and also many of the other tributaries within the watershed, except in relatively small creeks where sufficient wood is already available. Modifying the Long Tom River below Fern Ridge Dam by reducing channelization also would improve habitat for fish, especially for any potential use by chinook. Structuring in the valley areas may increase pool habitat and contribute to cooler water. This also may increase localized flooding, so such projects should be planned carefully. Increased ponding and reestablishment of wetlands would improve the habitat and water quality for various aquatic species.

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Riparian vegetation management may be continued to increase growth rates of conifers. Establishment of large conifers in the future would be expected to further improve habitat conditions by providing more shade, lower water temperatures, and additional large wood for natural entry into the stream. Planting trees in riparian areas to increase shading would help to reduce water temperatures, particularly in tributaries. Riparian thinning and conversion would be beneficial actions to improve stream channel structure. Establishment of more conifers would be of value where hardwoods and brush are thinned and also in some existing grass areas. Vegetative management may be needed throughout most of Long Tom Watershed.

Management during future logging, road construction, and agricultural activities is important for adequate protection of existing conditions and improvement of future habitat. This includes various measures that are already used for protection of riparian vegetation and for reduction of erosion and stream siltation. Habitat protection would continue to be necessary throughout the watershed during land management activities.

Management for improvement of water quality has a high priority in the watershed. Improved control of stream bank erosion, channel erosion, chemicals, other water pollution, and stream flows would improve water quality and fish habitat conditions. Reduction of surface erosion, especially off roads, would further improve water quality.

Removal of barriers should have first priority for improvement of fish habitat. Management opportunities for fish passage improvements at the dam in Monroe and various irrigation dams need to be further identified (including for potential chinook migration). Replacement of road culverts and channel modifications to reconnect streams would increase the connectivity for fisheries and habitat.

Stream crossings have been observed in parts of the Long Tom River Watershed where there are fish passage problems at culverts that often have a drop at the outfall and may have steep gradients BLM field records contain specific information, and locations are shown on a maintenance map. Additional observations are needed at other culverts for information on passage problems. Following are some locations where culverts may be improved for upstream passage for fish, amphibians, and macro-invertebrates:

Long Tom River at Road No. 16-7-1.1 in T16S, R7W, Sec 1, SE1/4. (Road washed out over culvert).
Long Tom tributary at Road No. 16-7-1 between Road Nos. -1.1 and 1.2 in T16S, R7W, Sec 1, SE1/4.
Long Tom tributary at Vik Road No. 16-6-20 in T16S, R6W, Sec 19, SE1/4.
Ferguson tributary at Road No. 15-6-26 in T15S, R6W, Sec 26, NW1/4.
Ferguson tributary at Road No. 15-6-26.2 in T15S, R6W, Sec 27, SE1/4.
Tributary to Ferguson tributary at Road No. 15-6-26.2 in T15S, R6W, Sec 27, SE1/4.
Jones tributary at Road No. 16-6-9 in T16S, R6W, Sec 9, (middle of section).
Poodle tributary at County Road 4354 in T17S, R7W, Sec 1, SW1/4.
Poodle tributary at Road No. 17-6-18 in T17S, R6W, Sec 18, SE1/4.
Hayes Creek at Road No. 16-7-25 in T16S, R7W, Sec 25, SW1/4.
Elk Creek tributary at Road No. 17-6-30 in T17S, R6W, Sec 30, NW1/4.
Swamp Creek (Elk Creek Tributary) at Road No. 17-7-22.5 in T17S, R7W, Sec 23. NW1/4.
Cedar Creek (Elk Creek Tributary) at Road No. 17-7-27.3 in T17S, R7W, Sec 28, NE1/4.
Battle Creek tributary at Road No. 18-5-31 in T19S, R5W, Sec 6, NE1/4.

Bear Creek (tributary to Coyote Creek) at Road No. 19-5-22.1 in T19S, R5W, Sec 22, SW1/4.
Coyote Creek tributary at Road No. 19-4-4 in T19S, R4W, Sec 4, SW1/4.

Land exchanges may be considered relative to fisheries in coordination with other agencies and private landowners. BLM ownership in the Long Tom Watershed is limited, and exchanges could be proposed to add more public lands in some locations. Currently no opportunities for exchanges to benefit fisheries have been identified in the watershed.

Management opportunities would be further determined and projects would be planned for specific locations at each stream after more complete field information is obtained on current fish habitat conditions. Coordination with ODFW, the Long Tom Watershed Council, other public agencies, private companies, various landowners, other organizations, and the public would be continued concerning future stream improvements within the watershed. BLM fisheries management is designed to be consistent with Aquatic Conservation Strategy objectives, as prescribed by the NFP/ROD Standards and Guidelines and also the Eugene District RMP/EIS and ROD.

WILDLIFE

Wildlife management opportunities emerge when comparisons are made between the existing condition and the desired condition of the watershed. The disparity in wildlife species composition and habitat structure between these two conditions indicates what types of projects could bring the watershed closer to the desired condition. A number of possibilities present themselves within the Valley Fringe. These range from specific projects to general management practices that could be implemented during routine projects. The opportunities listed below are designed to increase the occurrence of limited habitat components and unique wildlife components, improve the quality of some existing components, and encourage processes that stabilize fluctuations spatially and temporally.

Opportunities for General Habitat Structure

Process Reestablishment - from a management perspective, fire (prescribed burning) is the most effective process that is within human control. Opportunities for prescribed burning should be exploited within the watershed to encourage nutrient cycling, natural snag creation, and unique habitat/prey base creation. In addition, allowing rather than curtailing some processes may be appropriate in some circumstances such as leaving blown down timber; allowing some insect, disease, and decay processes; creating and implementing a let-burn plan; and leaving "unmanaged stands" alone. An integrated natural fuels strategy is currently under development that would identify possible approaches to return forests to a more balanced condition.

Ecotone/Valley Edge Savannah Creation - review of historic vegetation maps indicate that the Valley Fringe supported a wide band of open growth Douglas-fir stands interspersed with ponderosa pine habitats and oak woodlands. Opportunities to create and maintain similar sites within today's landscape could help perpetuate these currently unique components.

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Protect, Enhance, and Encourage Unique Components wherever possible.

Road Closure/Obliteration - Road corridors also influence distribution patterns of wildlife species ranging from large mammals (use roads for travel) to invertebrates (roads are impassable barriers for some). They also influence accessibility to wildlife for humans and create corridors that enable invasion by exotic plant and animal species. Closing roads reduces these effects as well as fragmentation of similar habitats.

Exotic/Nonnative Control - discourage nonnative plant and animal invasion into any and all habitats within the Valley Fringe. This may include chemical control, bio-releases, road reclamation, travel/recreation management, and fragmentation reduction (edge management).

Studies/Inventory/Monitoring - information gathered from studies, inventories, and monitoring is invaluable in determining the appropriate management options to employ as well as determining their effectiveness. These opportunities must go hand in hand with any other management possibilities.

Opportunities for General Forest Structure

Patch Size Management - Interior Creation - several opportunities exist in the Valley Fringe to create larger patch sizes of similar tree structure. Some of these options include private lands (older forest pieces around T15S R5W Sections 1, 12, and 13) while others are completely within federal ownership. Reducing high-contrast edge and creating larger patches improves the quality and security of interior forest habitat - a component that has been reduced recently.

Edge Reduction/Blurring - strategic placement and careful selection of timber management practices can reduce the amount and severity of forest edge created during the project. Opportunities to minimize edge should be exploited.

Linkage Habitats - Opportunities to allow similar structured linkages to establish between isolated patches are available within the watershed and should be developed. Planning for no activities in these stands may be appropriate. Also, management practices that can hasten favorable structural development, in some cases, such as under burning or mechanical thinning between isolated forest sites may be desirable to facilitate the creation of connectivity. Conversely, careful planning to avoid linkage sites for more aggressive treatments (regen harvests) is also necessary.

Increase Within-Stand Tree Species Diversity - generally in the intensively managed forests of today most stands consist of evenly-spaced, even-aged Douglas-fir trees. Historically, several other subdominant tree species occupied forest stands with Douglas-fir. Opportunities exist within the Valley Fringe to encourage the establishment of other species within the managed stands such as cedar, hemlock, chinquapin, madrone, yew, and ponderosa pine, to name a few. Planting, creating small openings, and prescribed burning are tools that could help create greater tree species richness.

Opportunities for Old Forest Structure

Old Growth Structure "Construction" - There are several opportunities to enhance or create a more favorable "old growth" stand structure within the Valley Fringe, particularly on the LSR lands. Critical elements to old growth structure such as **snags and coarse woody debris** can be created and/or protected in most stands. Target stands could benefit from thinning, **small (<½ acre) opening creation**, and under-burning to allow for greater individual tree growth and a less uniform stand structure. These elements create greater structural variety as well as other components (large wolfy trees, big limbs, micro sites) that are attractive to many specially designated wildlife species such as marbled murrelet, spotted owl, and Survey and Manage Mollusks.

Opportunities for Riparian Structure

Riparian Overstory Management - opportunities to maintain conifer-dominated riparian sites are available in the Valley Fringe. Managing for conifer-dominated riparian areas as opposed to deciduous-dominated sites (specifically red alder) is desirable because of the current scarcity of such sites.

Beaver Reintroduction - Where habitat exists, every opportunity should be taken to introduce beaver into the drainages of this watershed. However, much of the BLM managed land in the Valley Fringe is unsuitable as beaver habitat. Reintroduction to any BLM lands that could support beaver is desirable.

BOTANY

Botanical Surveys - Surveys for Special Status vascular plant species have been and should continue to be conducted in conjunction with project work including timber sales, fisheries restoration projects, road rights-of-ways, recreation projects, etc., to provide for opportunities to locate, protect, and/or enhance populations. These surveys have usually been associated with project clearances to ensure adherence with the Endangered Species Act (1973), the Northwest Forest Plan (1994), and the Eugene District Resource Management Plan (1995). At present, only 18 percent of BLM lands in the Long Tom Watershed have been surveyed for SSS plants. Although these efforts should continue, complete coverage of the watershed is not expected because of personnel and budget restrictions. With additional surveys, the BLM overall species occurrence "picture" will improve and provide a better base on which to make management decisions.

To date, limited information is available on the distribution and life history of Protection Buffer (PB), Survey and Manage (S&M), and other non-vascular plant species. In-house surveys have been conducted on the Eugene District to a very limited extent. Only 1.1 percent of the BLM lands in the watershed have been surveyed for these species. These surveys should be increased in the future through contracts and in-house efforts. Most importantly, region-wide surveys (outside of planned project areas) for PB and S&M species should be conducted by the BLM State Office

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or the Regional Ecosystem Office to determine the true distribution and extent of populations of these species.

West Eugene Wetlands Project Area - Special Status Species

A Challenge Cost Share with The Nature Conservancy is soon to be completed that outlines a Conservation Strategy for rare plant species of Willamette Valley ecosystems found in the West Eugene area. The Strategy will recommend various management activities to be implemented to conserve and enhance populations of these species and their associated plant communities including recommendations for Long Tom ACEC. Thereafter, BLM could develop a management plan for the Long Tom ACEC or propose the entire West Eugene Wetlands Project area be designated an ACEC representing rare plant communities of the Willamette Valley. A management plan could then be developed for all of the West Eugene Project area.

BLM should continue to participate in actions to implement the Recovery Plan for Bradshaw's lomatium.

BLM should participate in the development and implementation of Recovery Plans for Willamette Valley Daisy and Kincaid's lupine, both species Proposed for Federal listing under the Endangered Species Act.

BLM should continue to implement management actions and accompanying vegetation monitoring for enhancing various rare species of interest in the West Eugene Wetlands Project area. Habitat restorations, wetland habitat development, and mitigation should continue under the West Eugene Wetlands Plan and Partnership.

Additional studies should be initiated and/or expanded upon to determine the response of rare plant species and plant communities to management treatments (e.g., prescribed burning, mowing), genetics studies, surveys of animal and insect compositions, and responses to management treatments. These studies would help determine best practices for managing Willamette Valley ecosystems and their rare plant components.

Forest Fringe - Special Status Species, Protection Buffer, and Survey and Manage Species

Little information is available on the life histories or ecologies of SSS, PB, or S&M species. Studies on life history of these species would provide insights into management impacts and opportunities to maintain and/or enhance populations of these species. Little research has been conducted on the response of Special Status, Protection Buffer, and Survey & Manage species to changes in environmental conditions such as those typical of various management treatments. These species need to be monitored in relation to management treatments to assess methodologies for maintaining and/or enhancing populations. Some species may be intolerant of specific management treatments; thus, studies should be conducted to determine the size of effective reserves for maintenance of these species.

BLM will continue to participate in the Conservation Strategy for tall bugbane, *Cimicifuga elata*. Surveys to date indicate that 11 sites of tall bugbane occur on BLM lands in the Long Tom Watershed and opportunities to enhance populations were identified in the Conservation Strategy. BLM should continue to implement projects as described in the Strategy to enhance populations of this species.

BLM should participate in the development and implementation of a Conservation Strategy for wayside aster (*Aster vialis*), since the Eugene District is in the center of geographic distribution for this species. The single population that occurs in the Long Tom Watershed should be included in any genetic studies that are conducted on this species.

BLM should initiate a study to examine the response of branching montia (*Montia diffusa*) to prescribed fire and other management activities in an effort to ultimately enhance conditions for this plant.

Coarse Woody Debris (CWD) may be in disproportionate quantities in relation to historical levels (presumably lower now). Research that determines what natural range of quantities of CWD that were present across the landscape and how it was distributed, and what species are closely associated with CWD would be important in developing future biological and management decisions (e.g., where in the landscape have CWD "jack pots" naturally occurred, and how do these relate to abundance and distribution of vascular and non-vascular species?). Opportunities to maintain and increase CWD in various decay classes across the landscape will help assure maintenance of vascular plant, fungi, lichen, and bryophyte diversity in the Long Tom Watershed. Opportunities to enhance quantities of CWD should continue to be incorporated into planned timber sales and other project work.

Lichen species are generally thought to be very dispersal limited (they just do not disperse propagules very far from their point of origin; Neitlich and McCune 1995, Sillett and Neitlich 1996; Peck and McCune 1997). Because of past cutting levels and landscape fragmentation, the current distribution of many lichen species may be much reduced from historical levels. Management practices to enhance dispersal may be needed to ameliorate past practices. New management practices may be as simple as selecting leave trees in harvest regeneration units with good populations of dispersal-limited lichens at high points in the landscape (on ridges) to assist in landscape dispersal. The BLM role may be especially important given the checkerboard ownership of the Long Tom Watershed landscape and the likely abolition of population points on private lands from which these species reestablish and disperse.

Fire History - Few studies have documented the historical fire history of the Coast Range Province. It is assumed that fire was an important modifier of stand compositions and structure in the Coast Range. The fire record is quickly disappearing with the disintegration of information contained on cut, old tree stumps. Stand age and fire events can be discerned from tree rings and fire scars evident on newly cut forest units but the ability to "read" this information quickly fades within the climatic (and decompositional) regime of the Coast Range. Fire history studies should be conducted (while there is still time to read the fire record) to help us understand dynamics of forest ecology in order to conduct sound land management. Information from fire history studies might help us understand the distribution of various rare plants, special habitats, and stand structures as well as various plant associations across the landscape.

Native Plant Communities - There is little availability of local native plant sources for any of the BLM Eugene District. The use of nonnative seed mixtures for various erosion problems continues to imperil local native plant communities, particularly with the introduction of noxious weeds in contaminated seed lots. In order to maintain native plant communities across the land (BLM Eugene District Policy - particularly in LSR), **sources for native seed and plant materials should be developed,** particularly for erosion control purposes.

Studies need to be conducted to determine seed zones for a suite of species to be developed for erosion control seed mixtures. Development of seed stocks should be sensitive to variations in genetics associated with environmental factors such as elevation, watershed, etc. It is unknown how site specifically adapted these species may be and thus how far we can distribute particular seed sources across elevations, watersheds, etc. In addition to genetic and common garden studies, seeds need to be hand-collected and increased in grow-outs. Germination studies need to be conducted over time to ascertain how long seed stocks maintain viability and thus how long stocks can be stored. Availability of seed quantities will need to be coordinated with project needs.

Special Habitats and Additional Special Areas - Little specific information is known about special habitats found in the Long Tom Watershed. A detailed inventory of special habitats should be conducted including a classification of habitat types (e.g., tufted hairgrass prairie, bog, rocky outcrops, etc.), complete plant species lists, soil type, disturbance history, size of habitat, and identification of likely habitats for specific rare plant species. This effort would help in understanding the types, size, quantity, and distribution of special habitats across the landscape, what processes are necessary to maintain special habitats, and thus, how best to manage for various special habitats. There may also be opportunities to incorporate some special habitat areas into our Special Areas Program (e.g., Areas of Critical Environmental Concern, Research Natural Areas, Outstanding Natural Areas, and Environmental Education Areas).

Plant Associations and Additional Special Areas - An effort to determine plant associations on the Eugene District began some years ago and plant association guidebooks should soon be completed. BLM personnel should then be trained to determine plant associations so that this valuable information can collected and incorporated into management planning. The Oregon Natural Heritage Plan (1998) has assessed the current reserve systems (such as Research Natural Area and Wilderness Areas, etc.) inclusion of various representative plant communities. They have identified critical plant communities that are not represented in any sort of a reserve system. Surprisingly, a number of critical plant communities that are not currently identified in the reserve system are communities that are thought to be relatively common in the Coast Range Resource Area. Little data has been collected on what plant communities are present in the Long Tom watershed. The BLM should search and identify candidate areas within the Long Tom Watershed area, particularly in LSR blocks, that might be representative of missing plant

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communities that could be included within our program of Special Areas, particularly for Research Natural Areas.

Noxious Weeds - Development of an integrated pest management plan that includes noxious weed control in the Long Tom Watershed is needed to reduce noxious weed populations below levels that impair the viability of native species. Specific strategies might include:

1. Compliance with the Integrated Weed Management Guidelines identified in the *Noxious Weed Strategy for Oregon/Washington* (USDI 1994).

2. A noxious weed "screen" in interdisciplinary analysis of on-the-ground projects such as timber sales, recreation facilities, etc.

3. Restoration of special status plant reserves, native communities, and special habitats to provide "competitive exclusion" of noxious weeds where necessary and possible.

4. Coordination with road maintenance personnel to reduce the spread of noxious weeds, such as limiting mowing of infested roadsides to specific phenological time frames for the plants, and assuring weed-free gravel sources.

5. Within the Transportation Management Planning process, explore opportunities to close roads to prevent the further spread of noxious weeds and to eradicate noxious weed concentrations in conjunction with (prior to) road closures.

6. Coordination with State, County, and other federal agencies and private land owners to control current noxious weed infestations and reduce the spread of noxious weeds.

A District-wide inventory of noxious weed infestations was conducted in 1996 and mapped into GIS during 1997. Not all roads were surveyed during this effort and additional on the ground checking should be conducted prior to establishing contracts for noxious weed control.

VEGETATION

Silvicultural Practices Within Riparian Reserves

Riparian Reserves Silviculture Objectives - One of the objectives of the Aquatic Conservation Strategy is to "maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration, and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." To accomplish this and other related aquatic objectives, silvicultural practices in the Riparian Reserves (RR) within the Long Tom Watershed will need to focus on accelerated development of large green trees, snags and coarse woody debris, multilayered canopies, and increased tree species diversity. Restoring large conifers to the Riparian Reserves in this watershed should be emphasized because past management practices have resulted in hardwoods and dense, young (less than 80 years of age) conifer stands dominating the riparian areas over a large portion of the watershed.

General Silvicultural Practices in Riparian Reserve - As stated earlier, approximately 58 percent of the Riparian Reserves within the BLM ownership are in the younger age classes (clear cut, sapling pole, and pole-young). Hardwoods and mixed conifer hardwood make up an additional 18 percent of the BLM ownership within Riparian Reserves. BLM has less then one percent of its ownership within the valley fringe analysis area in nonforest. Mature and old forests account for only 14 percent of the Riparian Reserve within BLM ownership within the valley fringe analysis area as modeled.

Due to the current young condition of the Riparian Reserve, many opportunities for stand management and manipulation exist within the Riparian Reserves. There will be more opportunity in the upper 1st, 2nd, and 3rd order reaches of the stream system due to the existing ownership pattern within the watershed. Within the Long Tom valley fringe, BLM manages 25.7 percent of the vegetation along 1st, 2nd, and 3rd order streams and only 7.6 percent of the vegetation along 4th order and larger streams within the watershed. Cooperative agreements with private landowners could be pursued to maximize the conservation of the aquatic ecosystem. There may be opportunities to accomplish riparian restoration projects through partnerships within the watershed. The current presence of the Long Tom Watershed Council and the presence of interested landowners could facilitate the accomplishment of such restoration projects on private land holdings.

Silvicultural practices should concentrate on releasing existing conifers from overtopping hardwoods and brush; thinning densely-stocked young stands to encourage development of large conifers; and converting areas in the Riparian Reserves, where hardwoods dominate, to a more diverse composition including conifers by creating openings or patch-cuts. Site-specific prescriptions may differ depending on the specific area and may require silvicultural treatments (site preparation, planting and replanting, animal protection, and vegetation management) for seedling survival and establishment where conifers are needed. Species conversion projects should be focused on areas within the Riparian Reserves adjacent to the streams to allow for the development of large conifers for future CWD input into streams. These treatments will be used to establish or restore conifers to hardwood dominated areas of the Riparian Reserve for sources of large CWD to streams and the riparian in the future.

In areas of homogenous conifer stands with high crown closure, density management treatments could be used to accelerate the development of large conifers to provide future sources for large snags, down wood, and in-stream structure. Density management treatments and patch-cuts accompanied by silvicultural treatments (site preparation, planting and replanting, animal protection, and vegetation management) could be used to accelerate the development of late-successional habitat, create multi-layered stands, and provide for species diversity within the Riparian Reserve. Patch-cuts could be left to develop on their own as small gaps or openings or could be underplanted with native hardwoods, brush, Douglas-fir, or shade tolerant conifer species to produce a more diverse stand.

These treatments within the Riparian Reserve are needed to benefit species composition and structural diversity of plant communities; to maintain or provide future habitat for aquatic and riparian dependent species in riparian areas; and to provide spatial and temporal connectivity within and between watersheds. (ACS objectives, B-11 of the ROD)

Silvicultural Practices by Vegetation Class Within Riparian Reserves

Small Openings (Brush patches) and Existing Clear Cuts - Silvicultural treatments (site preparation, planting and replanting, animal protection, and vegetation management) may be necessary within the Riparian Reserve to ensure seedling survival and establishment. Genetically improved stock should be utilized when available for planting.

Sapling-pole - Silvicultural treatments, including precommercial thinning (PCT) and fertilization, should emphasize individual tree growth to restore large conifer canopies and promote tree species diversity within the Riparian Reserve.

Pole-young- Density management within the Riparian Reserve would be designed to redistribute growth among individuals, species, or portions of stands to promote or restore large conifer canopies and diversity within the Riparian Reserve for the benefit or attainment of the Aquatic Conservation Objectives (ACS). Density management treatments may allow for commercial harvest and should be accomplished at the same time the adjacent upland areas are treated. Depending on stand conditions, other treatments could include fertilization of conifer stands to accelerate the development of large trees; killing trees to make snags and coarse woody debris; creating gaps and leaving understory trees to develop a multi-layer canopy; and underplanting to develop a multi-storied canopy. Cone collection may be required to ensure availability of local seed for reforestation or planting needs.

Hardwood and Mixed Conifer Hardwood - Silvicultural treatments should emphasize releasing existing conifers and creating gaps within hardwood stands that would be planted with conifers. Site preparation, planting (Douglas-fir, western red cedar, and western hemlock), animal protection (survival and early growth), and vegetation management (maintenance and release) should be prescribed on a site by site basis. Once a stand conversion project is initiated, monitoring and follow-up maintenance and release treatments will be critical.

Silvicultural Practices in Late-Successional Reserves

LSR Silviculture Objectives - The *LSR Assessment, Oregon Coast Province-Southern Portion - (R0267, R0268)* has been completed and lists management triggers, and appropriate activities within Late-Successional Reserves (LSR). Chapter IV of this watershed analysis describes how the LSR lands within the watershed function as part of the bigger landscape and includes management goals and priorities for treatment within these LSR lands. This information was taken directly from the LSR assessment. The treatment priorities set at the LSR assessment level were based on securing the best habitat first by blocking up large patches and connecting isolated patches. This would be accomplished by treating young stands (i.e., ≤ 80 years) adjacent to large blocks of mature habitat or between large blocks of mature habitat.

Silvicultural systems proposed for Late-Successional Reserves have two principal objectives: (1) development of old growth forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and (2) prevention of large scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the reserves to sustain viable forest species populations.

Any management actions within the LSR must also be integrated with special management criteria required for other reserve and management designations overlapping the LSR. These reserve and management designations are listed in Chapter 4.

General Silvicultural Practices in LSR - There are approximately 7,838 acres of Late-Successional Reserve (LSR) within the Long Tom valley fringe analysis area. The LSR makes up approximately 38 percent of the BLM administered lands within the analysis area. The LSR is predominantly young and fragmented with approximately 4,179 acres or 53 percent less than 80 years old (i.e., clear cut, sapling pole, and pole-young vegetation classes using Thrailkill vegetation data). Due to the current young, fragmented condition of much of the LSR, there should be opportunities for a variety of silvicultural treatments to accelerate the development of late-successional characteristics within these stands.

The silvicultural practices recommended for late-successional forests in the Long Tom Watershed should focus on managed stands younger than 80 years old. These are stands that have been regenerated following timber harvest or stands that have been thinned. However, thinning (precommercial and commercial) can occur in stands younger than 80 years old regardless of origin if needed to create and maintain late-successional forest conditions. Major emphasis should be on stand establishment (reforestation, protection, and release) along with growth and structure enhancement (precommercial thinning, density management, and fertilization).

These silvicultural practices can accelerate the development of young stands into multilayered stands with large trees and diverse plant species, and structures that may maintain or enhance species diversity. Silvicultural prescriptions should include leaving trees for future snags and legacy trees. Snags and coarse woody debris should be retained based on site-specific analysis and the guidelines in the Late-Successional Reserve (LSR) Assessment and ROD.

Silvicultural Practices by Vegetation Class Within LSR

Patch Cuts and Existing Clear Cuts - Silvicultural treatments (site preparation, planting and replanting, animal protection, and vegetation management) may be necessary within Late-Successional Reserves to ensure seedling survival and establishment for future development of late-successional conditions. Where species diversity is minimal, stocking is low, and an opportunity is still available to reforest an area, additional tree species should be planted. In most cases this would mean planting Douglas-fir mixed with shade tolerant species such as western red

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cedar and western hemlock where site conditions are favorable. Genetically improved stock should be utilized when available for planting.

Sapling-Pole - Silvicultural treatments, including PCT and fertilization, are needed to maintain or increase individual tree growth rates. Species diversity should be maintained or enhanced as part of the PCT prescription.

Pole-Young - Density management treatments (thinnings) within this vegetation class of the Late-Successional Reserve are needed to open up the canopy and accelerate the development of young stands into mature, multilayered stands with large trees and diverse plant species, and structures that may maintain or enhance species diversity. Density management treatments are needed in the existing even-age stands to increase diversity of plants and animals and hasten transition to a forest with mature characteristics. Density management or thinning will provide additional growing space to maintain or increase diameter growth rates and crown development. In addition, openings in the canopy would permit development of an understory of seedlings, saplings, and other vegetation. Some of the overstory trees will need to be converted to snags over time to help meet snag habitat targets or felled to provide large woody debris. Trees cut but surplus to habitat needs would be removed for commercial use. Cone collection may be required to ensure availability of local seed for reforestation or planting needs.

Depending on stand conditions, needed treatments to move stands to the desired late-successional condition include thinning and/or fertilization of conifer stands to accelerate the development of large trees; killing trees to make snags and coarse woody debris; creating gaps (patch-cuts) with planting and release of understory trees to develop a multi-layer canopy; underplanting to develop a multi-storied canopy; and favoring species other than Douglas-fir, if available, to increase species diversity. This should mainly occur in stands that have been planted and/or have been thinned in the past as these lands will acquire late-successional characteristics more rapidly with treatment; however, these treatments could occur in stands regardless of origin if needed to create and maintain late-successional forest conditions.

Silvicultural Practices within the Matrix (GFMA and Connectivity)

Matrix (GFMA) Silviculture Objectives - As discussed in Chapter 4, silvicultural systems in the General Forest Management Area (GFMA) are designed to promote production of merchantable timber, while retaining some larger trees and snags and maintaining forest health and productivity. Needed management actions within the GFMA will normally consist of 6 general types of treatments to accomplish these objectives:

- regeneration harvest with partial retention;
- site preparation following harvest;
- reforestation treatments;
- management of young stands;
- commercial thinning in mid-aged stands; and
- management of overstory trees, snags, and large woody debris.

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Any management actions within the GFMA must also integrate the special management criteria required for other reserve and management designations within the GFMA land use allocation. These reserve and management designations are listed in Chapter 4.

Approximately 10.8 percent of the Long Tom valley fringe and approximately 51.8 percent of the BLM ownership within the watershed is in the GFMA (includes Riparian Reserve). Approximately 46 percent of the GFMA is within Riparian Reserves as modeled in GIS.

Approximately 26 percent of the BLM forested acres within the GFMA are in the 0, 10, and 20 year age classes (using FOI data) that would provide young stand management opportunities. Approximately 64 percent of the BLM forested acres within the GFMA are in the merchantable 30-70 year age classes (using FOI data) that would provide commercial thinning and regeneration harvest opportunities. Current FOI data shows approximately 10 percent of the GFMA within the Long Tom Watershed as late-successional (≥80 years of age). All of this late-successional habitat within the GFMA would be deferred from regeneration harvest to meet the 15 percent late-successional habitat requirement for the watershed (see paragraph addressing the 15% requirement in Chapter 4).

Matrix (Connectivity) Silviculture Objectives - As discussed in Chapter 4, silvicultural systems in the Connectivity/Diversity blocks will be designed to promote development of late-successional forest structure within a longer rotation, while providing an output of merchantable timber and maintaining forest health and productivity. Lands available for harvest will be managed generally as even-aged stands with substantial overstories of larger trees. Needed management actions will consist of 6 general types of silvicultural treatments to accomplish these objectives:

- regeneration harvest with partial retention;
- site preparation following harvest;
- reforestation treatments;
- management of young stands;
- density management thinning in mid-aged stands; and
- management of overstory trees, snags, and large woody debris.

Any management actions within the Connectivity must also integrate the special management criteria required for other reserve and management designations within the Connectivity land use allocation. These reserve and management designations are listed in Chapter 4.

Approximately 2 percent of the Long Tom valley fringe and approximately 9.7 percent of the BLM ownership within the watershed is in the Connectivity (includes Riparian Reserve). Approximately 67 percent of the Connectivity is within Riparian Reserves as modeled in GIS.

Approximately 43 percent of the BLM forested acres within the Connectivity are in the 0, 10, and 20 year age classes (using FOI data) that would provide young stand management opportunities. Approximately 26 percent of the BLM forested acres within the Connectivity are in the merchantable 30-70 year age classes (using FOI data) that would provide density management and regeneration harvest opportunities. Current FOI data shows approximately 32 percent of the Connectivity land use allocation within the Long Tom Watershed as late-successional (≥80 years of age). All of this late-successional habitat within the Connectivity would be deferred from regeneration harvest to meet the 15 percent late-successional habitat requirement for the watershed (see paragraph addressing the 15% requirement in Chapter 4).

General Silvicultural Practices in the Matrix (GFMA and Connectivity)

Silvicultural treatments (site preparation, planting and replanting, animal protection, vegetation management, hardwood conversion, and cone collection for reforestation seed) may be required within the Matrix to ensure seedling survival and the establishment of young stands to provide future timber commodities. Genetically improved stock should be utilized when available for planting.

Silvicultural treatments, including precommercial thinning, commercial thinning (density management), and fertilization, will be needed to maintain or increase stand vigor and growth rates for timber commodities. Regeneration harvest would occur in the Matrix to provide timber commodities. Species diversity should be enhanced or maintained as part of the thinning prescriptions. Pruning to encourage the production of clear wood within the boles of trees may occur to increase the value of the commodities produced.

A good percentage (approximately 54%) of the forested acres within the Matrix (includes GFMA, Connectivity, and Riparian Reserve using FOI data) are in the merchantable 30-70 year age classes that will provide commercial thinning and density management opportunities. The 60-70 year age classes in the upland Matrix (GFMA and Connectivity) could provide regeneration harvest opportunities in the short term.

OTHER OPPORTUNITIES

PARTNERSHIPS - Due to the limited BLM ownership along the 1st, 2nd, and 3rd order streams, and the even more limited ownership along the larger 4th order streams within the watershed, it may be necessary to enter into cooperative agreements both with the public and with private and/or State agencies to accomplish stream restoration projects within these reaches. The current presence of the Long Tom Watershed Council and the presence of interested landowners could facilitate the accomplishment of such restoration projects on private landholdings.

LAND EXCHANGES - Land exchanges should be explored where appropriate for increasing the BLM's ability to manage resources more effectively.

> **Land Ownership Exchanges - LSR** - As discussed in Chapter 4, land ownership exchanges or acquisitions of lands should be considered when it would facilitate the ability of the LSR to function. The ROD (C-17) itemizes legitimate reasons for land exchanges providing the benefits are equal or greater to current conditions of the LSR either in area distribution or habitat quality. Strategic points in the Corridor LSR zone (lands dispersed within the LSR south of Hwy. 126 within the Long Tom Watershed) were given a Priority 2 for land exchanges. Those lands within the Buffer LSR zone (lands dispersed within the

LSR north of Hwy. 126 within the Long Tom Watershed) were given the lowest priority for blocking ownership to benefit the function of the LSR on a landscape scale (refer to page 80 of the LSR assessment for these priorities).

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APPENDIX B
BOTANY

SPECIES OF INTEREST KNOWN TO OCCUR
Long Tom Watershed.

SPECIES NAME	COMMON NAME	HABITAT	STATUS
Asclepias fascicularis	Narrow-leaved milkweed	W	Of interest in Lane County
Asclepias speciosus	Showy milkweed	W	Of interest in Lane County
Allotropa virgata	Candystick	F	Survey & Manage
Aster vialis	Wayside aster	F	Bureau Sensitive
Aster curtus	White-topped aster	W	Bureau Sensitive
Calochortus uniflorus	Short-stemmed star tulip	W	Of interest in Lane County
Calycadenia truncata	Tarweed	F	Of interest in Lane County
Cicendia quadrangularis	Oregon timwort	W	Bureau Assessment
Cimicifuga elata	Tall bugbane	F	Bureau Sensitive
Erigeron decumbens	Willamette daisy	W	Proposed Federal Endangered
Geranium oreganum	Oregon geranium	W	Of interest in Lane County
Horkelia congesta	Shaggy horkelia	W	Bureau Sensitive
Isoetes nuttallii	Nuttall's quillwort	W	Of interest in Lane County
Lathyrus holochorus	Thin-leaved peavine	W	BLM Tracking
Lomatium bradshawii	Bradshaw's lomatium	W	Federally Listed Endangered
Lupinus sulphureus kincaidii	Kincaid's lupine, sulphur lupine	W	Proposed Federal Threatened
Montia diffusa	Branched montia	F	BLM Tracking
Montia howellii	Howell's montia	W	Bureau Sensitive
Orobanche pinorum	Pine broomrape	F	Of interest in Lane County
Sidalcea cusickii	Cusick's checkermallow	W	BLM Tracking
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	W	Bureau Sensitive
Verbena hastata	Blue verbena	W	BLM Tracking

F = forest fringe habitat. W = Willamette Valley habitats.

Recommended Strategies for Management of *Cimicifuga elata* Sites Long Tom Watershed from the Conservation Strategy (1996).

AGENCY SITE NAME	LOCATION	CONSERVATION MEASURES TO BE APPLIED*						
		1	2	3	4	5	6	7
33 and 1	T16S, R6W, Sec 1	1a	X	3b	X			
Owen's Flat	T15S, R6W, Sec 34	1a	X	3b				
Jones Hall	T16S, R7W, Sec 12	1a	X	3b				X
Fox Hollow	T19S, R4W, Sec 9	1a	X	3b	X		X	
Camas Territory	T19S, R4W, Sec 31	1a	0	3a	X		X	
BLM Road # 19-4-4 (2 Sites)	T19S, R4W, Sec 9	1a		3c	X	X		
Growl and Howl #1	T19S, R5W, Sec 15	1a	0	0	X		X	
Growl and Howl #2	T19S, R5W, Sec 16	1a	0	0	X		X	

*** Conservation measures to be applied:**

1. **Population Status**
   - a. **Selected population**
   - b. **Nonselected population**
2. **Habitat Enhancement**
3. **Monitoring:**
   - a. **Population health monitoring**
   - b. **Management treatment monitoring/case study monitoring**
   - c. **Defensibility monitoring**
4. **Seed/Fruit collection and cryogenic storage**
5. **Management of roadside selected populations**
6. **Management of selected populations within reciprocal ROW agreements**
7. **Reintroduction**

0. **To be determined**

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APPENDIX C
Vegetation

Tables

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Table C-1 - Vegetation Classes (1956) - within the Long Tom Watershed Fringe

Vegetation Classes	* Total Acres	Percent of Watershed	Number of Patches	Percent of Total Patches	Mean Patch Size (*acres)
Clear Cut	2,992	3.1	58	3.7	52
Sapling-Pole	26,414	27.1	263	16.6	100
Pole-Young	19,800	20.3	340	21.4	58
Mature over Young	3,903	4.0	108	6.8	36
Mature	14,909	15.3	178	11.2	84
Old Over Young	0	0.0	0	0.0	N/A
Old Forest	4,410	4.5	55	3.5	80
Hardwoods	1,544	1.6	30	1.9	51
Mixed Conifer/Hdwds	754	0.8	5	0.3	151
Nonforest	22,689	23.3	548	34.6	41
TOTALS	97,415	100%	1,585	100%	61

Table C-2 - 1997 Vegetation Class Distribution Between Owners Within Long Tom Watershed Fringe

Vegetation Class	* Total Acres	* BLM Acres	Percent of Total	*Other Owner Acres	Percent of Total
Clear Cut	10,494	2,896	27.6	7,598	72.4
Sapling-Pole	9,187	4,033	43.9	5,154	56.1
Pole-Young	34,127	5,156	15.1	28,971	84.9
Mature over Young	3,333	903	31.1	2,430	68.9
Mature	2,109	489	27.1	1,620	72.9
Old Over Young	2,981	1,177	39.5	1,804	60.5
Old Forest	3,756	2,947	78.5	809	21.5
Hardwoods	10,238	1,778	17.4	8,460	82.6
Mixed Conifer/Hdwds	6,360	824	13.0	5,536	87.0
Nonforest	14,830	139	0.9	14,691	99.1
Totals	97,415	20,342	20.9	77,073	79.1

*Acres are based on GIS mapping and are approximate.

Table C-3 - 1997 Vegetation Class Distribution Within LUAs - *(BLM Lands Only)*

Vegetation Class	* LSR Acres	* GFMA Acres	* CON Acres	* BLM Acres
Clear Cut	1,750	715	431	2,896
Sapling-Pole	813	2,564	656	4,033
Pole-Young	1,616	3,366	174	5,156
Mature over Young	313	587	3	903
Mature	221	232	36	489
Old over Young	464	700	13	1,177
Old Forest	1,423	966	558	2,947
Hardwood	708	1,010	60	1,778
Mixed Conifer/Hardwood	486	328	10	824
Nonforest	44	74	21	139
Totals	**7,838**	**10,542**	**1,962**	**20,342**
Percent of BLM Lands	**38.5%**	**51.8%**	**9.7%**	**100%**
Percent of Watershed Fringe	**8.1%**	**10.8%**	**2%**	**20.9%**

* Acres are based on GIS mapping and are approximate.

LSR	Late-Successional Reserves
CON	Connectivity
GFMA	General Forest Management Area

Table C-4 - Riparian Reserves by LUA - All Forested BLM Lands*

[illegible]	[illegible] LUA	[illegible] Riparian
General Forest Management Area	5,167	46%
Connectivity	821	67%
Late-Successional Reserve (LSR)	3,569	45%
District Designated Reserves	10	83%
Total BLM in Riparian Reserve	9,567	46%

* (includes BLM lands within and outside the Long Tom fringe)

Table C-5 - Summary of Riparian Reserves by Vegetation Class Within the Long Tom Fringe

	All Lands		BLM Lands	
Vegetation Class	*Acres in Riparian Reserve	% of Riparian Reserve	*Acres in Riparian Reserve	% of Riparian Reserve
Clear Cut	1,956	12.0	1,412	15.0
Sapling Pole	2,250	13.8	1,936	20.6
Pole Young	3,951	24.3	2,120	22.6
Mature Over Young	482	3.0	324	3.5
Mature	257	1.6	154	1.6
Old Over Young	732	4.5	522	5.6
Old Forest	1,251	7.7	1,141	12.1
Hardwoods	3,090	19.0	1,301	13.9
Mixed Conifer Hardwoods	1,020	6.3	406	4.3
Nonforest	1,277	7.9	73	0.8
TOTALS	16,266	100%	9,389	100%

* Acres are based on GIS Mapping and are approximate.

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Table C-6 - Characterization of Streamside Vegetation Within the Long Tom Watershed Fringe (BLM and Private - 100 ft. each side of stream channel)

[illegible] Vegetation Class	1st, 2nd and 3rd Order Streams		4th Order and Larger		All Streams Regardless of Ownership
	BLM lands	Private lands	BLM lands	Private lands	
Clear Cut	14.8%	9.5%	4.1%	6.4%	10.3%
Sapling Pole	21.3%	5.0%	11.2%	1.3%	8.3%
Pole Young	18.2%	28.0%	13.5%	13.7%	23.9%
Mature Over Young	3.4%	2.8%	1.2%	0.2%	2.6%
Mature	1.2%	1.8%	2.3%	0.7%	1.5%
Old Over Young	6.5%	3.0%	0.6%	0.8%	3.5%
Old Forest	11.5%	0.9%	15.3%	0.8%	3.4%
Hardwoods	16.5%	20.0%	41.8%	38.2%	21.6%
Mixed Conifer Hardwood	5.8%	9.3%	4.1%	4.1%	7.8%
Nonforest	0.8%	19.8%	5.9%	33.8%	17.1%
Totals	100%	100%	100%	100%	100%

Table C-7 - Ownership Along Streams Within the Long Tom Watershed Fringe (BLM and Private- based on area 100 ft each side of stream channel)

1st, 2nd and 3rd Order Streams		4th Order and Larger Streams		All Streams	
BLM lands	Private lands	BLM lands	Private lands	BLM lands	Private lands
25.7%	74.3%	7.6%	92.4%	23.4%	76.6%

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Vegetation Classification

The vegetation description for the Long Tom Watershed fringe area focuses primarily on the types, species composition, age, and structural characteristics of the trees. This was done to describe the vegetation in a consistent manner across all ownerships and obtain information useful for the analysis. The following is a description of the classes used to describe the vegetation (Thrailkill, Perkins, Meslow 1990):

NONFOREST - All areas not producing a stand of trees with ≤ 40 percent canopy closure. This also includes rockland areas, quarries, agricultural and pasture lands, brushfields, and other miscellaneous barren ground.

HARDWOODS - Primarily red alder and bigleaf maple with > 60 percent hardwood canopy closure. These stands are often associated with wetlands or streamside areas. Some large scattered conifers including Douglas-fir, hemlock, and cedar may be present, which increases the structural complexity and attributes of the stand.

MIXED CONIFER HARDWOOD - Hardwood species, primarily red alder and bigleaf maple, make up at least 40 percent of the canopy closure. The remaining stand is dominated by Douglas-fir and may include western hemlock or red cedar.

CLEAR CUT - Approximate age range is 0 to 10 years, but may remain for 20 to 30 years if reforestation was delayed or unsuccessful. Shrub and tree regeneration is less than 40 percent of the canopy closure and generally less than 3 meters (~10 feet) in height. The units may range from recently harvested and mainly devoid of vegetation to areas dominated by herbaceous species (grasses and forbs), shrubs, tree seedlings, and/or resprouting hardwoods.

SAPLING-POLE - These areas range in age from approximately 10 to 29 years. Saplings are 3 to 13 cm (~1 to 5 inches) in diameter; poles are from 13 to 28 cm (~5 to 11 inches) diameter breast height (dbh). The average canopy closure varies with tree density. The sapling stands form a branching habit that is very dense and limber. Dead limbs tend to be retained, restricting access to the canopy. The pole stands form a less dense branching habit.

POLE-YOUNG - The approximate age of these stands is 30 to 79 years. Pole stands are 13 to 28 cm (~5 to 11 inches) dbh whereas the young stands range from 28 to 53 cm (~11 to 21 inches) dbh. These areas average greater then 60 percent tree canopy. The branch structure on the young stands is moderately stout, creating owl availability in most of the canopy. Mistletoe brooms may start to develop and live crown ratios are variable but are decreasing with increasing crown closure. Within the dense stands, competition-related mortality (suppression) creates small diameter snags and down woody material.

MATURE OVER YOUNG - These are "uneven" aged stand, usually in the pole-young condition, with less than 50 percent of the canopy in mature size timber in the overstory. An

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element of old forest-sized trees (greater than 86 cm, 34 inches dbh) may be present as well as a hardwood understory. These stands may exhibit structural characteristics associated with large mature or old forest stands.

MATURE - These areas range in age from 80 to 199 years. The average stand dbh is greater then or equal to 53 cm to 86 cm (~21 to 34 inches). The canopy closure is greater than/equal to 40 percent and may be fully stocked at 100 percent. The branch structure is stout. The more open or patchy stands may have developed a layered canopy with varied understory. Dense stands, which have developed under intense competition, may retain a small live crown ratio and little or no understory. The stand development is directional towards a more open canopy and understory.

OLD OVER YOUNG - These areas are "uneven" aged stand usually in the pole-young condition with less than 50 percent of the canopy in old forest-sized trees. An element generally less then 10 percent of mature size trees may be present as well as a hardwood understory. These areas generally exhibit structural features associated with old forest stands.

OLD FOREST - These areas are 200-year old stands with the dominant overstory in trees 86 cm (34 inches) dbh. A well-developed multi-layer, multi-species canopy exists. Large snags, downed wood, and tree decadence are also present. The overstory may be composed of long-lived successional species such as Douglas-fir or climax species like western hemlock. The understory may be dominated by conifers, hardwoods, and/or shrubs.

SERAL STAGE DESCRIPTIONS

EARLY SERAL STAGE - This seral stage occurs from the time of disturbance that exposes bare ground to the time when the site is revegetated with conifer or hardwood saplings. Domination of the site with hardwood and/or conifer saplings typically occurs before 15 years after disturbance. The first 2 to 5 years are usually dominated by grass, forbs, and herbaceous vegetation followed by a dominance of shrubs and/or hardwoods. Species diversity is highest in this seral stage and biomass is relatively low, but increases rapidly throughout this stage. The conifers develop slowly at first, but gradually become dominant. Once conifer dominance occurs and the crowns close to fully occupy the site, then the early seral stage is concluded (USDI, BLM 1991). These descriptions assume that all stands in this seral stage have developed as a result of man-caused disturbance (forest management), and there are no stands in this seral stage that have resulted from natural disturbances.

There are 3 separate stand conditions that exist during the early seral stage (Brown et al. 1985):

Grass-Forb Stand Condition
Shrub Stand Condition
Open Sapling-Pole Stand Condition

Grass-Forb Stand Condition - Usually lasts 2 to 5 years and occasionally as long as 10 years. After timber harvest or disturbance, the area is usually devoid of vegetation for the first growing season. Resident herbs and new plants quickly dominate the site. Some shrubs and sprouting hardwoods may be present, but not yet dominant. This stage can be bypassed if residual overstory tree cover does not create openings, e.g., a shelterwood harvest.

This stage has been defined by Brown et al. (1985) as shrubs less than 40 percent crown cover and less than 5 feet tall; unit may range from mainly devoid of vegetation to dominance by herbaceous species (grasses and forbs); tree regeneration generally is less then 5 feet tall and 40 percent crown cover.

Shrub Stand Condition - The shrub condition typically lasts from 3 to 10 years, but can remain for 20 or more years if tree regeneration fails or is delayed. Shrubs become the dominant vegetation and provide some habitat for wildlife that is different from the grass-forb condition. Tree regeneration is common, but the trees are generally less then 10 feet tall and provide less then 30 percent of the crown cover.

This stage has been defined by Brown et al. (1985) as shrubs greater than 40 percent crown canopy; they can be any height; trees less than 40 percent crown canopy and less than 1 inch dbh. When trees exceed 1 inch dbh for the stand average, they should be classified in the "open sapling" or "closed sapling" category.

Open Sapling-Pole Stand Condition - This stand condition exists when the trees reach 10 feet in height but still have less then 60 percent crown cover. The trees generally average less then 1 inch in dbh. A dominant shrub understory is common and generally consist of vine maple, hazel, oceanspray, thimbleberry, salal, and Oregon grape. This stage in stand condition may be bypassed if initial stocking densities exceed 400 to 500 trees per acre. This stage can also be reinitiated or prolonged through precommercial thinning. This stage may last from 8 to 20 years depending upon tree crown closure and subsequent stand treatments.

This stand condition is defined as "average stand diameter greater than 1 inch dbh and tree crown canopy less than 60 percent." Saplings are 1 to 4 inches dbh.; poles 4 to 9 inches dbh."

MID SERAL STAGE - This stage is characterized by dominance of conifers (from the time of crown closure to the time of first merchantability). This stand condition can also be called closed sapling-pole sawtimber or stem exclusion stage (Oliver and Larson 1990). These sites are characterized by a dense conifer stand, a closed canopy with crown cover ranging from 60 to 100 percent, and a relatively low occurrence of understory vegetation. Stands typically exhibit these characteristics between 16 and 45 years of age.

The overstory trees are growing very rapidly and begin to lose their lower, deeply shaded foliage and branches, stem growth slows down, and the stem form becomes more tapered. As individual trees within the stand differ in individual growth rates and occupy different amounts of growing space, some trees gain a competitive advantage. Because the overstory is growing very rapidly,

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the larger more dominant trees begin to overtake the growing space of smaller less competitive individuals. This process is called stand differentiation and is generally manifested first in diameter differences, and then later in height differences. Stand differentiation creates a stand with individual trees of different crown sizes and positions, as well as different heights and diameters. This allows for a classification of individual trees by canopy position or crown class -- dominants, codominants, intermediates, and overtopped or suppressed.

Species diversity decreases in most cases. These stands can change to large sawtimber and eventually old growth if thinning treatments and long rotations are used. The size and number of snags and coarse woody debris is dependant upon the stand origin. Managed stands created by forest management during the past decades tend to be devoid of large snags and downed logs. However, a large number of small snags are present. These snags are created by the stand differentiation and competition mortality, which tend to be the smaller sized trees in the intermediate and overtopped crown classes. Natural stands may have a greater number of snags and large downed logs that are legacies from the original forest as well as the high amounts of small snags and downed logs created by competition mortality. These existing natural stands tend to be limited in the number of large snags as a result of past fire management policies, but still have some levels of downed logs. Those snags and downed logs currently present tend to be in the more advanced decay classes: classes 3, 4, and 5 (Brown et al. 1985).

This stand condition can be defined as "average stand diameters between 1 and 21 inches dbh and crown cover exceeding 60 percent." The average stand diameter range used can overlap into the late seral stage, depending upon stand management treatments applied and the site productivity.

LATE SERAL STAGE - This stage typically is characterized by openings in the canopy with a corresponding increase in forbs and shrubs or the understory reinitiation stage. Species diversity, although minimal, is once again beginning to increase but at a slower rate than what occurred in the early seral stage. For conifer growth, it is the time of first merchantability to the time of Culmination of Mean Annual Increment (CMAI). During this period, stand diversity is low but increasing. Stands generally exhibit these characteristics between 46 and 80 years.

These stands typically have large numbers of small diameter snags and downed logs resulting from stand density and competition related mortality. The large diameter snags and downed logs, legacies from the previous forest, tend to be few in number, limited in distribution, and those present are typically in the more advanced decay classes. The number of legacy and small diameter snags and downed logs tend to be greater in naturally regenerated stands. Past management activities and silvicultural treatments like precommercial and commercial thinning tend to decrease the number of small snags and downed logs present in stands that have experienced some form of management.

MATURE SERAL STAGE - This stage typically occurs between ages 81 and 195. Stand diversity is gradually increasing in response to openings in the canopy created by windthrow, disease, insects, and stand mortality. Biomass is still increasing but at a relatively slow rate. For conifers it is the time from CMAI to an old growth stage.

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This stage could also be called the large sawtimber stand condition that is characterized by trees with an average dbh of 21 inches or larger. The conifers usually exceed 100 feet in height with crown cover generally less than 100 percent, permitting the development of ground vegetation. Stands in the mature seral stage generally have a more open canopy than the mid seral aged stands. These stands create different wildlife habitat then smaller sized stands. Natural stands in this condition can have nearly as much standing and downed woody material as old growth stands while stands that have had silvicultural treatments applied are generally lacking in standing and downed woody material. These stands also tend to lack the more tolerant, successional understory species required for the old growth stage.

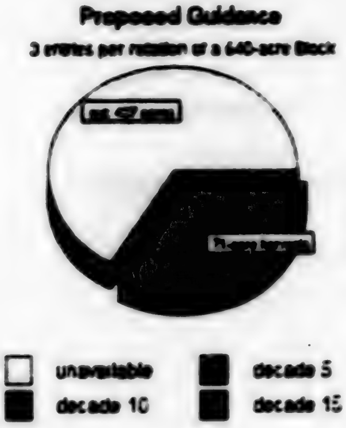
OLD GROWTH SERAL STAGE - This stage typically occurs after 195 years and represents both climax and subclimax plant communities. The subclimax condition may, in fact, persist for centuries depending on the frequency of natural disturbances. Whether in the climax or subclimax condition, old growth is characterized by 2 or more tree species with a wide range of size and age including long-lived seral dominants, decadence of the long lived dominants, a deep, multi-layered canopy, significant amounts of snags and downed logs, and openings or gaps in the canopy. More tolerant conifers (western hemlock and western red cedar) and/or shrub species occur in the understory or in the gaps and openings caused by windthrow or other disturbance. Old growth stands are optimal habitat for saprophytic plants, lichens, mosses, and liverworts. Biomass reaches a maximum and species diversity approaches the level found in the early seral stages.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
EUGENE DISTRICT OFFICE

PLAN MAINTENANCE

ISSUE: AREA CONTROL ROTATION OF CONNECTIVITY/DIVERSITY BLOCKS

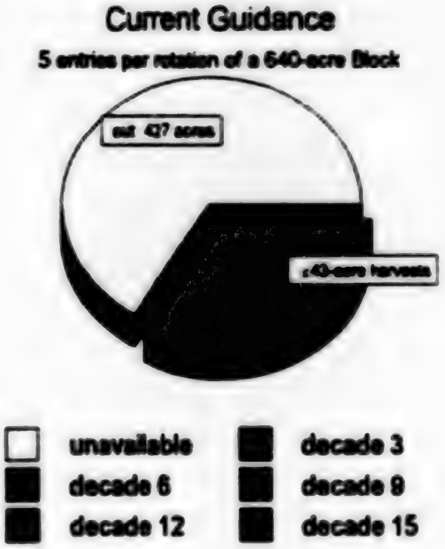
The Eugene District Resource Management Plan (RMP) states:



> *Connectivity/Diversity Block standards or guidelines will be managed for 150-year area control rotations* (p. 35)
>
> *Plan regeneration harvest at a rate of approximately 1/15 of the available acres in the connectivity part of a sustained yield unit per decade. Because of the limited size of operable areas within any given block, up to three decades of harvest could be removed at any one time from a single block in order to make viable harvest units. Eventually each connectivity block will have 4 to 5 different 10-year age classes represented. The future desired condition across the entire sustained yield unit would have up to 15-16 different 10-year age classes represented* (pp. 86-87).

This guideline will have unintended negative results, both operationally and ecologically.

Limiting each entry to no more than three decades of harvest (i.e., 1/5 of the available acres in the Block) will result in a minimum of 6 age classes (including the old growth in unavailable acres) at the end of the 150-year rotation, not the 4 to 5 age classes anticipated.



Limiting each entry to no more than three decades of harvest will result in small harvest units, which will frustrate attempts to create less landscape fragmentation. Riparian Reserves, unmapped Late-Successional Reserves, and other unavailable acres do not contribute to the 150-year area control rotation, because these areas are not available for scheduled timber harvest. The area of each Block available for harvest in a single entry may be as too small to achieve the desired future condition of the Block. For example, in a 640-acre Block, as much as

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two-thirds is likely to be unavailable, leaving 213 acres available. Therefore, 14 acres could be harvested per decade (which is considerably less than the 32 acres per decade that was originally modeled). The flexibility provided in the RMP would allow harvest of up to 43 acres at one time. Even this acreage is likely to be fragmented by unavailable acres and land ownership patterns and limited by operational constraints, usually resulting in harvest units as small as 20 acres.

PLAN MAINTENANCE

Therefore, the following wording of the RMP is changed to better achieve the desired future condition in Connectivity/Diversity Blocks, from

> *Because of the limited size of operable areas within any given block, up to three decades of harvest could be removed at any one time from a single block in order to make viable harvest units.*

to

> *Because of the limited size of operable areas within any given block, multiple decades of harvest could be removed at any one time from a single block in order to make viable harvest units.*

This minor change or refinement of a previously approved decision in the RMP is accomplished with plan maintenance and does not result in expansion of the scope of resource uses or restrictions or change the terms, conditions, and decisions of the approved RMP. This maintenance action is not considered a plan amendment.

DISTRICT MANAGER
Eugene District

United States Department of Agriculture **Forest Service** **R-5** **R-6** **OR/WA** **CA** **Bureau of Land Management** **United States Department of Interior**

Reply to: 1736-PFP(BLM-OR931)P / 1950(FS) **Date:** September 14, 1998

EMS TRANSMISSION 9/14/98
FS-Memorandum **BLM-Instruction Memorandum No. OR-98-100**
Expires 09/30/99

To: USDA Forest Service Supervisors Within the Area of the Northwest Forest Plan; USDI Bureau of Land Management District Managers (Coos Bay, Eugene, Lakeview, Medford, Roseburg, Salem) and Area Managers (Arcata, Redding, and Clear Lake, CA; and Klamath Falls, OR)

Subject: Implementation of the 15 Percent Retention Standard and Guideline

The Northwest Forest Plan (NFP) federal executives, with supporting research, analysis, and discussion among the Regional Ecosystem Office (REO) and agency staff, reached agreement on a number of principles related to the 15 percent retention Standard and Guideline (S&G) (Attachment 1) found in the NFP Record of Decision (ROD), pages C-44 and C-45. The federal executives' agreement is contained in the REO memorandum to the federal executives dated October 24, 1997 (Attachment 2).

The federal executives agreed that the subject S&G does not operate alone; it is one of many S&Gs that were designed collectively to protect species and habitats associated with late-successional (mature and old growth) forest ecosystems. They acknowledged that late-successional forest stands of a variety of ages may possess the characteristics necessary to meet the stated intent, and that age alone is generally not a sufficient criterion for stand retention selection.

The following guidance incorporates the federal executives' agreement and provides recommendations to the field for consistent implementation of the 15 percent retention S&G.

Intent

The 15 percent retention S&G is designed to retain and protect ecologically significant forest stands, patches, and fragments that provide biological and structural diversity to function as refugia for old-growth associated species in watersheds where little late-successional forest remains. Benefitting from this mitigation are the full array of species identified in Appendix J-2 of the Final Supplemental Environmental Impact Statement (FSEIS).

Agency discretion to retain a variety of stand ages to meet the intent of the S&G should be applied before federal forest lands reach the 15 percent level of late-successional forest. Management discretion and options to select stands for retention and protection within a watershed only exist prior to late-successional forest reaching the 15 percent level. Old-growth stands would be retained and protected to meet the S&G in most instances; however, based on an assessment, younger stands could be retained while older stands could be harvested. Land managers may retain and protect older stands to meet the intent of this S&G despite implications to Probable Sale Quantity (PSQ). The retention and protection of these stands could be modified in the future when other portions of the watershed have recovered to the point that they could replace the ecological role of these stands.

Terminology

For purposes of implementing the 15 percent retention S&G, the following acronyms and terms are defined:

Federal Forest Land - Federal land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use (Forest Ecosystem Management Assessment Team (FEMAT) Report, p. IX-13), including lands administered by the Forest Service, Bureau of Land Management (BLM), National Park Service, Fish and Wildlife Service, Department of Defense, and Bureau of Reclamation.

Fragment - Mappable forest area generally less than 10 acres and larger than 2.5 acres. See *Stand or Patch.*

J-2 Species - The full array of species identified in Appendix J-2 of the FSEIS, which benefit from retention and protection of late-successional forest under this S&G.

Land Manager - The BLM Area Manager, Forest Service District Ranger, National Park Service Superintendent, or other federal official with land management decision making authority.

Late-Successional Forest - Forest seral stages which include mature and old-growth age classes.

The structure and composition of late-successional and old-growth forest ecosystems have been detailed in numerous publications. Four major structural attributes of old-growth Douglas-fir forests are: live old-growth trees, standing dead trees (snags), fallen trees or logs on the forest floor, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory. Structural characteristics of late-successional and old-growth forests vary with vegetation type, disturbance regime, and developmental stage. For example, in many Douglas-fir stands in western Oregon and Washington, the mature phase of stand development begins around 80 years and is characterized by relatively large live and dead trees, although multiple canopy layers may not yet be well developed. In some forest types subject to frequent, low-intensity fire, such as ponderosa pine, the late-successional and old-growth stages are typically characterized by relatively open understories and relatively few large fallen trees (in comparison to more moist Douglas-fir/western hemlock types). Standards and guidelines designed to promote the desired conditions vary among physiographic provinces because characteristics of the natural structure and composition of late-successional and old-growth forests also vary among the provinces. (NFP ROD, p. B-2)

Mature Stand - A mappable stand of trees for which the annual net rate of growth has peaked. Stands are generally greater than 80-100 years old and less than 180-200 years old. Stand age, diameter of dominant trees, and stand structure at maturity vary by forest cover types and local site conditions. Mature stands generally contain trees with a smaller average diameter, less age class variation, and less structural complexity than old-growth stands of the same forest type. Mature stages of some forest types are suitable habitat for spotted owls. However, mature forests are not always spotted owl habitat, and spotted owl habitat is not always mature forest. (FEMAT Report, p. IX-20)

Old Growth Forest - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground. (FEMAT Report, p. IX-24)

Old Growth Associated Species - Plant and animal species that exhibit a strong association with old-growth forests. (FEMAT Report, p. IX-24)

Retain and Protect - Deferral of those management activities within retained areas, which are adverse toward meeting the intent of this S&G. Activities that are neutral or beneficial with respect to the intent of this S&G are not precluded within retained areas.

Refugia - Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range (i.e., endemic populations). (FEMAT Report, p. IX-28)

Reserved Land - These lands include Congressionally reserved areas, Late-Successional Reserves (LSRs), Managed Late-Successional Areas, Administratively Withdrawn Areas, and Riparian Reserves. Congressionally Reserved Areas include National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, Department of Defense lands, and other lands with congressional designations. (NFP ROD, p. 6)

Stand or Patch - Mappable forest area which is generally 10 acres or larger. See *Fragment.*

Watersheds - Designated fifth field watersheds on file at the REO. For consistency purposes, these fifth field watersheds, which were developed on an interagency basis and distributed by the REO, will be the basis for watershed assessments conducted under this S&G.

Assessment Levels - Each watershed will be assessed to determine what action should be taken to meet the 15 percent retention S&G. All federal forest lands within a fifth field watershed should be considered in the assessment. This assessment will be completed prior to implementation of management activities that would reduce the amount of late-successional forest within a watershed. (Attachment 3 diagrams the recommended assessment levels, which are described in this section).

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The S&G will be interpreted and implemented in the context of an assessment at the watershed scale. The assessment may be completed in conjunction with watershed analysis and/or site-specific analysis applied before, or as a part of, the National Environmental Policy Act (NEPA) process or the Endangered Species Act process (if appropriate to listed species). Land managers are responsible for determinations made during the assessment process. In addition, land managers are to ensure that assessments (including the rationale for identification and management of areas retained and protected under this S&G) are appropriately documented. (See Attachment 4.)

Level 1 Assessment

Are all federal forest lands within the watershed designated as either Congressionally reserved areas, LSR, or other reserved land?

- *Yes.* Document this assessment and determination. No additional assessment is required to implement this S&G.

- *No.* Proceed to a Level 2 Assessment.

Level 2 Assessment

Are management actions planned or proposed on federal forest lands within the watershed that would reduce the acreage of late-successional forest?

- *No.* Document this assessment and determination. No additional assessment is required to implement this S&G until such actions are planned or proposed.

- *Yes.* Proceed to a Level 3 Assessment.

Level 3 Assessment

Is the percentage of federal forest lands within the watershed currently comprised of 15 percent or less late-successional forest?

- *Yes.* Retain and protect all remaining late-successional forest stands, patches, and fragments identified through an assessment at the watershed scale. Document this assessment and determination. No additional assessment is required to implement this S&G.

- *No.* Proceed to a Level 4 Assessment.

Level 4 Assessment

Does an assessment of federal forest land within the watershed indicate that planned or proposed management actions would reduce late-successional forest to the 15 percent level? The assessment will examine the current amount of late-successional forest within the watershed, the assumptions for planned and proposed management actions, and the effects those management actions have on late-successional forest within the watershed. The assessment documentation will address the assumed time frames for land management actions, and the assumptions of harvest and growth of late-successional forest over time.

- *No.* Document this assessment and determination. Include age class distribution, the acreage of late-successional forest expected to be modified through management actions, and the proportion of the watershed in late-successional forest before and after those actions. Describe harvest and growth assumptions, including general time frames for planned and proposed management actions identified in this assessment. No additional assessment is required to implement this S&G.
- *Yes.* If the answer to the Level 4 question is yes, or if uncertainty regarding late-successional forest information or effects of planned or proposed management actions warrants a retention and protection determination at this time, proceed to a Level 5 Assessment.

Level 5 Assessment

Determine which late-successional forest to retain and protect to meet the 15 percent retention requirement of this S&G. The criteria for selecting forest to be retained and protected is that it have important ecological characteristics (e.g., structure, function, composition, stand size, and distribution), which provide favorable late-successional habitat for old-growth associated species. Benefitting from this mitigation are the full array of species identified in Appendix J-2 of the FSEIS.

Document this assessment and determination. Identify and map the late-successional forest stands, patches, and fragments that are retained and protected to meet this S&G. Document age class distribution, the acreage of late-successional forest expected to be modified through management actions, and the proportion of the watershed in late-successional forest before and after those actions. Describe harvest and growth assumptions, including general time frames for planned and proposed management actions identified in this assessment. Document the rationale for the selection of stands, patches, and fragments in terms of the intent of the 15 percent S&G. Retain and protect the selected forest.

Watersheds With Multiple Federal Land Managers

The federal land managing agencies within the watershed should coordinate on assessments. When a watershed is administered by multiple federal forest land management agencies, the following guidelines should be applied:

- The Forest Service and BLM should include all federal forest within the watershed as part of the assessment.

- If the federal land managing agencies agree to prepare a joint assessment for the watershed, then retention and protection measures may be distributed across the federal forest independent of agency boundaries.

- If an interagency assessment is not feasible, then an individual agency may implement the 15 percent S&G, on a proportionate basis, on lands it manages within the watershed. Retention may be distributed on federal forest on reserved lands, independent of agency boundaries. The remaining individual agency proportion of retention (outside of federal forest on reserved lands) would be selected on the individual agency land within the watershed. The results of the assessments will be shared among federal land managers within the watershed.

Consultation with Tribes
Consultations with affected Tribes on a government-to-government basis may be appropriate for some watersheds. Such consultations should occur prior to completion of the assessment.

Reassessment
A number of reasons may warrant reassessment of areas retained and protected under the 15 percent S&G, such as revised inventories, changes in management assumptions, Survey and Manage identification of ecologically significant stands, additional retention and protection of the watershed for other S&Gs, or catastrophic natural disturbance. In addition, retention and protection of stands, patches, and fragments could be modified in the future when other portions of the watershed have recovered to the point where they could replace their ecological roles. The stands designated for retention and protection are not fixed land management allocations; stands designated for retention and protection may change over time based on reassessment of the watershed.

Implementation of This 15 Percent Guidance and Near Term Management Actions
Management actions for which "NEPA decision" or "decision document" are signed, or the timber sale "Notice of decision" is published on or after October 1, 1999 (FY 2000), or which are to be offered or commence on or after October 1, 2000 (FY 2001), will be assessed under this 15 percent implementation guidance.

Adaptive Management Areas (AMAs)
Assessment and documentation requirements for the AMA land use allocation are the same as for Matrix lands except that the 15 percent level is a threshold for analysis rather than a strict standard and guideline. A proposal to modify late-successional stands when a watershed within an AMA is at or below the 15 percent threshold (forest areas identified in Assessment Levels 3 and 5) should only be implemented following an analysis that considers the ecological function of these stands and their location in the landscape.

If you have questions regarding this implementation guidance, please contact Larry Larsen of the Bureau of Land Management (503-952-6080), or Mike Rassbach of the Forest Service (503-808-2984).

/s/ Elaine Y. Zielinski
Elaine Y. Zielinski
State Director, OR/WA
USDI Bureau of Land Management

/s/ Robert W. Williams
Robert W. Williams
Regional Forester, Region 6
USDA Forest Service

/s/ Edward L. Hastey
Edward L. Hastey
State Director, CA
USDI Bureau of Land Management

/s/ G. Lynn Sprague
G. Lynn Sprague
Regional Forester, Region 5
USDA Forest Service

Authenticated by
Maggie Weaver
Management Asst.

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4 Attachments
- 1 - 15 Percent Retention Standard and Guideline
- 2 - REO Memo to Regional Executives dated 10/24/97
- 3 - 15% S&G Assessment Levels (Graphic)
- 4 - Documentation of Assessments and Determinations

BLM Distribution	cc:
WO-230 (Room 204LS) - 1	Mike Rassbach (FS R-6)
OR-931 (Larry Larsen) - 1	Sarah Crim (FS R-6)
OR-933 (Chris Cadwell) - 1	Don Knowles (REO Exec. Director)

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Attachment 1 - 15 Percent Retention Standard and Guideline

"Provide for retention of old-growth fragments in watersheds where little remains.

The distribution of old-growth stands throughout the landscape is an important component of ecosystem diversity, and plays a significant role in providing for biological and structural diversity across the landscape. Isolated, remnant old-growth patches are ecologically significant in functioning as refugia for a host of old-growth associated species, particularly those with limited dispersal capabilities that are not able to migrate across large landscapes of younger stands. These include, but are not limited to, many species of fungi, lichens, bryophytes, arthropods, and vascular plants, and will likely include vertebrate species such as small mammals and amphibians, and various bird species. Isolated patches will function as refugia where old-growth associated species are able to persist until conditions become suitable for their dispersal onto adjacent stands. Loss of these old-growth stands may result in local extirpation of an array of species. It is prudent to retain what little remains of this age class within landscape areas where it is currently very limited. This will ensure future options for management and enhancement of the diversity within adjacent developing stands.

"Landscape areas where little late-successional forest persists should be managed to retain late-successional patches. This standard and guideline will be applied in fifth field watersheds (20 to 200 square miles) in which Federal forest lands are currently comprised of 15 percent or less late-successional forest. This assessment should include all allocations in the watershed. Within such an area, all remaining late-successional stands should be protected. Protection of these stands could be modified in the future when other portions of the watershed have recovered to the point where they could replace the ecological roles of these stands.

"In Adaptive Management Areas, less than 15 percent of federal forest land in fifth field watershed in late-successional forest should be considered as a threshold for analysis rather than a strict standard and guideline. A proposal to modify such stands should only be implemented following an analysis that considers the ecological function of the remaining late-successional forest and its location in the landscape."

(Northwest Forest Plan, Standards and Guidelines, pp. C-44 and C-45)

Attachment 2 - REO Memo to Regional Executives dated 10/24/97

REGIONAL ECOSYSTEM OFFICE

333 SW First Street
P.O. Box 3623
Portland, Oregon 97208-3623
Phone: 503-808-2165 FAX: 503-808-2163

MEMORANDUM

DATE: October 24, 1997

To: **Regional Executives**

John D. Buffington, Western Regional Chief Biologist, USGS Biol. Resources Division
Tom Dwyer, Deputy Regional Director, U.S. Fish & Wildlife Service
Ken Feigner, Director, Forest & Salmon Group, Environmental Protection Agency
Thomas Mills, Station Director, Pacific Northwest Station, Forest Service
Thomas Murphy, Director, Environ. Research Lab, Environmental Protection Agency
Stan M. Speaks, Area Director, Bureau of Indian Affairs
William Stelle, Jr., Regional Administrator, National Marine Fisheries Service
William C. Walters, Deputy Regional Director, National Park Service
Robert W. Williams, Regional Forester, R-6, Forest Service
Elaine Y. Zielinski, State Director, Oregon/Washington, Bureau of Land Management

California Federal Executives

Ed Hastey, State Director, California, Bureau of Land Management
G. Lynn Sprague, Regional Forester, R-5, Forest Service

From: Donald R. Knowles, Executive Director

Subject: Review of Draft Guidance on the Standard and Guideline Entitled: "Provide for Retention of Old-Growth Fragments Where Little Remains" (also referred to as the "15 percent Retention" S&G)

Background

This memorandum responds to the Bureau of Land Management (BLM) and Forest Service (FS) July 25, 1996 request regarding the 15 percent Retention Standard and Guideline (S&G) and related draft guidance.

We were asked to review two draft documents: "Questions and Discussion Regarding the 15 percent Retention Standard and Guideline" and "Implementation of the 15 percent Retention Standard and Guideline." Specifically, we were asked to address two questions with respect to those documents: (1) is the interpretation of the 15 percent S&G implicit in both drafts consistent with the Northwest Forest Plan (NFP) and (2) are the draft screens and considerations in the implementation paper consistent with the

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NFP? Both documents were reviewed in light of the record associated with this S&G and background material presented by various agencies.

As a result of our review and interagency discussions on this topic, agreement was reached between the regional Federal Executives on the following principles that will allow the BLM and the FS to move forward with revising the draft implementation procedures and guidance for field units.

1. Following a discussion of the background of the NFP, the Regional Executives affirmed that the NFP represents a balance between species and ecosystem protection and sustainable production of socially and economically important goods and services. This overall balance must be maintained as this S&G is implemented.

2. The Regional Executives affirmed that the subject standard and guideline does not operate alone; it is one of many S&Gs that were designed collectively to protect species and habitats associated with late-successional (mature and old-growth) forest ecosystems. For example, it was noted that the survey and manage S&G also affects many of the same values as does the 15 percent retention standard.

3. In addition to other S&Gs, it was acknowledged that this S&G will be interpreted and implemented in the context of watershed analysis and additional site-specific analysis applied before or part of NEPA (and ESA, if appropriate to listed species).

4. The executives generally agreed that while the information to date on the effect of timber harvest under the NFP is not comprehensive, it indicates that we are not close to harvesting all the remaining old growth forest in the matrix, and that neither the BLM or FS are targeting older age classes for harvest at a rate disproportionate to their occurrence. There was a general agreement that it would be desirable to eventually develop a method of compiling and presenting BLM and FS data on the implementation of this S&G in a common report, and in a format that is easier to interpret and understand than currently available. It may be helpful to review implementation of this S&G in conjunction with ongoing monitoring efforts.

5. There was agreement that the agencies' goal is to meet all requirements of the NFP as stated in the ROD. As such, it was affirmed that the intent of the subject S&G was as stated in the first paragraph of intent on page C-44; i.e., to protect ecologically-significant patches and fragments of old growth habitat that provide refugia for old growth associated specie. This includes the full array of species identified in Appendix J-2 as benefitting from this mitigation. Given affirmation of this intent, the executives acknowledged that late-successional forest stands of a variety of ages may possess the characteristics necessary to meet the stated intent, and age alone is generally not a sufficient criteria for stand retention selection. In this light, it was affirmed that the second paragraph of the subject S&G on C-44 expressly provides agency decision makers with the discretion to select appropriate stands, 80 years or older, to meet the intent of the first paragraph. However, because agency discretion no longer exists when watersheds reach the 15 percent threshold (i.e., all late-successional stands must be retained), agency discretion to

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retain a variety of stand ages to meet the intent of the S&G should be applied before watershed reaches 15 percent of stands 80 years and older. It is expected that decision makers also carry the responsibility to adequately document the ecological rationale, in terms of the intent of the S&Gs, for whatever stands are selected for retention, through the analysis and review process described above (e.g., watershed analysis, and NEPA).

6. It was acknowledged that with the affirmation of the two paragraphs of the S&G stated above, that:

    a. Old growth stands will be retained to meet the S&G in most instances. However, as a result of analyses discussed in item 3, above, younger (e.g., 80 year old) stands could be retained while older stands could be harvested.

    b. Agencies will support their managers' decisions to retain older stands as determined necessary to meet the intent of the S&G, despite implications to PSQ.

7. The executives agreed that, based on the above principles, the FS and BLM will revise the proposed implementation procedures and field guidance previously submitted to the REO on July 25, 1996, taking into consideration agencies' analysis results to date and the executive agreements reached on September 25, 1997. The FS and BLM will resubmit the revised proposed implementation procedures and field guidance to the REO. The REO will solicit interagency review and comment regarding the degree to which the revised proposals combine the intent of the first S&G paragraph with the discretion of the second paragraph. The REO will consolidate the comments and provide them to the FS and BLM for consideration and appropriate incorporation into the final implementation process and guidance document. The Regional Executives agreed on the value of a set of implementation steps and field guidance that has interagency concurrence (within the bounds of the principles listed above), and agreed to work together to develop such guidance. All agencies will supply the final guidance package to the field for implementation.

We appreciate the opportunity to review the draft guidance and ask that you convey our appreciation to all your staffs for their support during this review. Based on discussions with the Portland Area Director of the Bureau of Indian Affairs, I would suggest that your field guidance include a reminder to consult with affected Tribes on a government-to-government basis, where appropriate, prior to final decisions by agency field units. If you have questions regarding our interpretations or need additional information, please contact your representative or me at 503-808-2166.

Enclosure
cc: REO Reps
1027/ly

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Attachment 3 - 15% S&G Assessment Levels (Graphic)

15% S&G Assessment Levels

Level 1

Are all federal forest lands within the watershed designated as either Congressional reserved areas, LSR, or other reserved land?

No ◆ Yes **Document this assessment and determination.**

Level 2

Are management actions planned or proposed on federal forest lands within the watershed that would reduce the acreage of late-successional forest?

Yes ◆ No **Document this assessment and determination.**

Level 3

Is the percentage of federal forest lands within the watershed currently comprised of 15 percent or less late-successional forest?

No ◆ Yes **Document this assessment and determination.**

Retain and protect all remaining late-successional forest stands, patches, and fragments identified through the assessment.

Level 4

Does an assessment of federal forest land within the watershed indicate that planned or proposed management actions would reduce late-successional forest to the 15 percent level?

Yes ◆ No **Document this assessment and determination.**

Level 5

Determine which late-successional forest to retain and protect to meet the 15 percent retention requirement of this S&G. The criteria for selecting forest to be retained and protected is that it have important ecological characteristics (e.g., structure, function, composition, stand size and distribution) which provide favorable late-successional habitat for old-growth associated species.

Document this assessment and determination.

Retain and protect the late-successional forest stands, patches, and fragments selectedto meet this S&G.

Attachment 4 - Documentation of Assessments and Determinations

Land managers must document their implementation of the 15 percent S&G. The scope of the documentation is dependent on the level of assessment needed and the amount of change expected in late-successional forest on federal lands. The following outline identifies basic information to be documented as part of an assessment at the watershed scale. Although this information is expected to be sufficient for most watersheds, land managers may include additional information needed to ensure that the documentation is commensurate with the assessment. The assessment may be completed in conjunction with watershed analysis and/or site-specific analysis applied before, or as a part of, the NEPA process or the Endangered Species Act process (if appropriate to listed species).

Documentation Common to All Assessments:

1. Watershed name and REO watershed number.

2. Agency/Agencies that manage federal land in this watershed.

3. Agency/Agencies participating in this assessment.

4. Tribal consultation for this watershed (as appropriate).

5. Description of current conditions including acres of federal forest (by agency, as appropriate).

6. Watershed map (GIS).

7. Determination and rationale; land manager(s) participating in the determination.

8. Date assessment completed and determination made.

Additional Documentation, by Level of Assessment:

Level 1 Assessment

Document the nature and extent of Congressionally reserved areas, LSRs, and other reserve lands.

Level 2 Assessment

Document that no management actions are planned that would reduce the acreage of late-successional forest including the general time frame assumed in making this determination.

Level 3 Assessment

Document the location, acres, and percent of federal forest stands, patches, and fragments of late-successional forest.

Level 4 Assessment

Document age class distribution, the acreage of late-successional forest expected to be modified through management actions, and the proportion of the watershed in late-successional forest before and after those actions. Describe harvest and growth assumptions, including general time frames for planned and proposed management actions identified in this assessment.

Level 5 Assessment

Identify and map the late-successional forest stands, patches, and fragments that are retained and protected to meet this S&G. Document age class distribution, the acreage of late-successional forest expected to be modified through management actions, and the proportion of the watershed in late-successional forest before and after those actions. Describe harvest and growth assumptions, including general time frames for planned and proposed management actions identified in this assessment. Document the rationale for the selection of stands, patches, and fragments in terms of the intent of the 15 percent S&G.

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APPENDIX D
Transportation Plan

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LONG TOM WATERSHED TRANSPORTATION MANAGEMENT PLAN

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Appendix B - Coast Range Resource Area, Human Use Risk Assessment

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Appendix G - South Valley Resource Area, Existing Road Inventory and Maintenance Levels.

Appendix H - South Valley Resource Area, BLM Road Control Map.

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LONG TOM WATERSHED
TRANSPORTATION MANAGEMENT OBJECTIVES

Prepared for the Coast Range Field Office, Eugene District BLM
December 1999

I. INTRODUCTION

The Long Tom Watershed in the Eugene District contains 145.29 miles of BLM controlled road within two Resource Areas; 110.2 miles in Coast Range and 39.09 in South Valley. The roads within the Coast Range Resource Area were analyzed by an interdisciplinary team to recommend a management objective for each road. This process involved three phases: 1) Mapping & Inventory, 2) Risk Assessments; and 3) Recommendations or Transportation Management Objectives.
South Valley Resource Area completed the first phase, Mapping and Inventory.

II TMP PROCESS SUMMARY

The process was completed using guidelines as shown in the draft: "Transportation Planning at the Watershed Scale, Eugene District", 1998.

PHASE I : Mapping & Inventory

This process involves a complete review of current BLM controlled roads in the watershed. The completed spreadsheet contains pertinent attributes to assist in determining a management objective for each road. The attributes are explained as follows:

1) Road Number. A numerical data base identifier for each road. The number is closely associated with Township, Range and Section where the road is located.

2) Segment. A Road Number may be comprised of one or more segments. Roads are segmented to delineate unique attributes such as.... control or ownership, reciprocal agreement cost sharing (see #8 below), or for changes in the surface type.

3) Road Name. A common name the road is referred to.

4) Mileage. The road or segment length measured to the hundredth mile.

5) Surface type. Three road surface types are: a) Aggregate Surface Course (ASC) or crushed rock, b) Bituminous (BST) or asphalt and; c) natural or dirt (NAT)

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6) Current Maintenance Level (ML):

Maint. Level	**Road Status**	**Description**
Level 1-	Closed	Decommissioned, should be blocked to vehicles, water barred, stream culverts removed.
Level 2-	Open Road	Local road. Minimal maintenance, may be seasonal, low use and/or passable only to high clearance vehicles.
Level 3-	Open Road	Local or collector road. Maintained for low to moderate use. Maintenance performed approximately once every 3 years. Inspected annually.
Level 4-	Open Road	Primary access. Collector or Arterial road. Moderate to high traffic. On regular annual maintenance cycle.
Level 5-	Open Road	Primary access. High traffic. Arterial road. On regular annual maintenance cycle.

7) Access rights. The rights acquired by BLM to either use or to access a BLM road (or segment). Although a road may be on BLM land, access may be limited to the following categories by the type of easement BLM has acquired across private land or privately controlled roads to reach the BLM road:

a) "BP" - BLM has acquired rights for the public to access the road, through an exclusive easement or is connected to other public roads;
b) "BR" - the BLM has administrative rights through a Reciprocal Agreement with a private landowner: Such rights do not authorize public access.
c) "BA" - BLM has acquired rights for administrative use only. Such rights do not authorize public access.
d) "NO" - the BLM has no legal access.

8) Shared (Y/N). This attribute is associated with Reciprocal Road Use Agreements. Although a shared road is BLM controlled, such a roads' capital value has been shared with the party BLM has the reciprocal agreement with. Therefore that party has bought into a percentage of that road. Any BLM proposal to close a road in which the non-controlling party has a capital investment, will need coordination and cooperation with that party.

9) Land Use Allocation (LUA). The land use allocation a road primarily serves or is within Matrix (MAT), Connectivity (CON), or Late Successional Reserve (LSR).

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PHASE II : Risk Assessments

The team evaluated each road or segment of a road, to determine: 1) the affects on natural resources (water quality, fish, wildlife, botanical). 2) the road's importance to the BLM timber/silviculture program. 3) the accessability to private timber lands and shared road ownership. 4) the affects on public access and recreational use. A matrix was usually used to evaluate and rate each road and impact values ranging from 1 (low) to 5 (high) were assigned to specific resource concerns.

PHASE III: Recommendations

Upon the completion of the Risk Assessments, the interdisciplinary team met to discuss each road and recommend a Transportation Management Objective (TMO). The TMO shall indicate whether a road shall be left open or closed. The Fuels specialist then reviewed the recommended closures to decide if a closed road conflicts with the need for fire access.

Roads recommended to be open shall have a recommended maintenance level assigned and possibly a recommended action (such as a gate or repairing the road) for resource protection.

III. COAST RANGE RESOURCE AREA - TRANSPORTATION PLAN

The purpose of the three phase analysis was to identify road related resource issues and evaluate aquatic, terrestrial and human uses. The management objective would recommend which BLM roads will be left open or closed and mitigate road problems.

The team members are as follows:

Graham Armstrong	Hydrology
Russell Hammer	Fisheries
Gary Hoppe	Landscape Planner
David Huber	Wildlife
Eric Meyers	Engineering
Saundra Miles	Recreation
Kathy Pendergrass	Botany
Phil Redlinger	Forestry/Silviculture
David Reed	Fire/Fuels
Mark Stephen	Ecology
Gary Wilkinson	GIS
Barry Williams	Soils

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Road System Overview

Of the 110.2 miles of BLM controlled road within the Coast Range Resource Area, the following summarizes the percentage of various attributes these roads have:

a) Surface Type -

Aggregate or crushed rock:	81.92 miles or 74%
Natural or dirt:	24.07 miles or 22%
Bituminous or asphalt:	4.24 miles or 4%

b) Land Use Allocation the road serves -

Matrix:	59.18 miles or 54%
LSR:	34.39 miles or 31%
Connectivity:	2.53 miles or 2%
Both LSR&Matrix	14.13 miles or 13%

c) Access Rights -

For the public (BP):	77.20 miles or 70%
For BLM use only (BA+BR)	27.30 miles or 25%
No access acquired:	5.43 miles or 5%

Key Issues

a) Public Use -

BLM administered land within the Long Tom Watershed is of close proximity to Eugene, Veneta, Crow, Elmira, and Junction City. It also interfaces to a large extent with rural homes and communities. The close proximity contributes to heavy public use within the watershed. Although most use by the public is recreational, considerable illegal and environmentally damaging activities also occur, presenting negative impacts to natural resources.

Such activities of concern and commonly observed have been garbage dumping, car abandonment, meth lab dumping, 4-wheeling, unsafe shooting practices, teenage parties, poaching, and motorcycle riding. Private landowners and the State of Oregon have voiced their concerns to BLM, particularly when private lands are affected because of the access BLM roads provide. The following are recent examples:

- Letter from Roseburg Resources Co., 10/13/98. This letter requests to install a gate on BLM controlled Road No. 18-6-5 due to 4x4 activity, parties, and dumping on Roseburg

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Resources Company land. The letter also states that a fire started in a freshly harvested RRC unit in August, 1999 and evidence suggests it was associated with a party.

- Several complaints were received from Falcon Cable Company since 1994, regarding repeated acts of vandalism to their communication site, also located off Road No. 18-6-5.

- Letter from Rosboro Lumber Company, 4/22/99. Request to block or gate BLM Road No. 15-6-33.5. This road, accessing both BLM and Rosboro property, had a methamphetamine dump discovered and a human caused fire in 1999. The road is also a familiar site for garbage dumping, 4-wheeling and shooting.

- Letter from Swanson Superior Forest Products, 10/21/99. Request to gate BLM Road No. 17-6-18 by three affected private landowners. The letter claims that 4-wheelers are gaining access to their lands via BLM. They are concerned about the occurrence of damage to resources from winter 4-wheeling and about the fire risk.

- BLM shared the cost of a gate with Coast Range Conifers on Road No.15-6-21 at the junction with Road No. 15-6-26 in 1997, attempting to block 4-wheelers from accessing Coast Range Conifers land to use as a race track. Repeated vandalism to the gate has made this effort difficult.

Allowing access to public lands while cooperating with adjacent landowners and protecting natural resources is an issue that needs to be considered.

b) Road Maintenance -

The maintenance of the BLM road system is also a key issue. Reduced budget and personnel in the road maintenance program since 1990 have made it impossible to maintain the entire road system. Of the 678 miles of road within the Coast Range Resource Area, a maximum of 380 miles are currently identified on the Road Maintenance Operating Plan to be maintained on a three year rotation. This leaves close to 300 miles of road without routine maintenance. Non maintained roads present a liability for both natural resources and safety as described below:

Increased sedimentation: A road not maintained over time usually develops ditches full of cut bank slough. Runoff will channel onto the road surface and into ruts from vehicle traffic, accelerating erosion. Uncontrolled runoff may seek exit from the road bed on fill areas or into a stream, thus increasing sedimentation .

Stream culverts have an approximate life span of thirty years and will eventually plug or rust out. When a culvert fails, saturation or erosion of the fill occurs, causing sedimentation as the fill erodes away or is suddenly washed out.

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Noxious weeds: Scotch broom is the most common roadside noxious weed in the watershed. This weed commonly encroaches the roadbed and if not kept in check by roadside brushing, may be spread off site by vehicles that come in contact with it.

Safety: 1) A lack of roadside brushing also reduces vehicle sight distance.
2) Inadequate drainage maintenance may cause road damage, affecting vehicle control.
3) An absence of road grading increases potholes and washboard which reduces vehicle control.

Two options available for roads that will not receive routine maintenance:

1) Leave the road open and design it for "zero maintenance" by installing drain dips to replace relief culverts. The road brush is kept from encroaching the roadbed by vehicle traffic. However, this does not address the noxious weed or safety concerns as mentioned above and only provides for adequate drainage management on roads without the presence of stream crossings. This standard of maintenance is defined as "Level 2".

2) Close roads through decommissioning. This is defined as a Maintenance "Level 1".

Objective-

Considering the maintenance, resource protection and public use issues above, objectives of the TMO process are to 1) reduce the miles of BLM road to be maintained through the decommissioning of roads not essential for human use, and 2) to identify essential roads to have mitigating measures implemented that protect resource values.

Mapping and Inventory

Inventory with existing Maintenance Levels.	- Refer to Appendix 'A'
BLM Road Control Map	- Refer to Appendix 'F'

Risk Assessments

- Human Uses Rating	- Refer to Appendix 'B'
- Aquatic Rating	- Refer to Appendix 'C'
- Terrestrial Rating	- Refer to Appendix 'D'

(Refer to Part II for ratings explanation)

Recommendations

Risk Assessment Rating Summary & Recommendation	- Refer to Appendix 'E'
Road Closure Map	- Refer to Appendix 'F'

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COAST RANGE TMP SUMMARY

There was an emphasis by the team to minimize road density in the watershed on roads where the management of BLM or private lands would not be affected. Most recommended road closures are spurs less than one mile in length. Eleven of the roads however, are between 1 and 1.62 miles long.

Several BLM roads in which private timber companies have shared ownership are recommended for closure and will need their concurrence.

The Forestry Specialist determined roads needed for projected timber sales and rehabilitation. The year in which a road shall be closed usually indicates when Precommercial Thinning is complete.

Two roads, #16-6-2.2 and #16-6-9 recommended by the team for closure, were found to be needed for fire management purposes by the Fuels Specialist. All other closure recommendations by the team met with the Fuels Specialist concurrence.

This Transportation Plan recommends that 50.52 miles of the 110.23 miles of BLM controlled road in the Long Tom Watershed within Coast Range Resource Area, be closed (46%) to vehicular traffic. These roads are recommended to be decommissioned to a Maintenance Level 1. This Level constitutes blocking the road to vehicles, water barring, pulling stream culverts and other actions necessary to stabilize the road without future maintenance. This includes 5.29 miles of BLM road currently closed (ML1). Roads that are presently closed shall be inspected to ensure they are adequately decommissioned. The year to close a road shall be dependent on budget and workload constraints. Unless specified in the "Year to Close" column of the Transportation Manangement Objectives, roads designated for closure may be upon completion of the required environmental clearances and the designated prescription.

The Record of Decision and Resource Management Plan for the Eugene District, June 1995, Appendix F, designated seasonal closures totaling 14.21 miles on various roads in both South Valley and Coast Range Resource Areas to protect natural resources. Some of these roads are recommended to be closed in Coast Range. These roads are as follows: 16-6-1, 16-6-2.1, 16-5-7, 15-6-33.5, 15-6-33.6, 16-6-33.1, 16-6-33.2, 16-6-33.3, 16-6-33.4, 17-7-15 and 17-6-30.1C. South Valley Road Nos. 19-4-9, 19-4-9.1, 19-4-17 and a portion of 19-4-4, totaling 0.88 miles were decommissioned in 1994. The approval of the Long Tom Watershed Analysis would modify Appendix F of the ROD, which states: "there could be necessary modifications within these designations based upon watershed analysis......."

The remainder of BLM roads (59.71 miles) are recommended to be open with a

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designated Maintenance Level from 2 through 4. The Maintenance Level may change due to changes in traffic volume or maintenance availability.

COAST RANGE TMP IMPLEMENTATION

Work Items -

1) Close 50.52 miles of road to a "Maintenance Level 1", by blocking, water barring, stream culvert removal and other actions necessary to stabilize the road without future maintenance. Implementation will be staggered due to the designated "Year to Close" as shown in Appendix F.

2) Review the 5.29 miles, currently in a "Level 1" condition, to ensure they meet the criteria as described above.

3) Roads designated as "Maintenance Level 2" shall be left open to vehicles, but shall have drain dips and/or water bars installed to ensure drainage.

4) Replace, repair or mitigate stream culvert problems identified in Appendixes D&F.

Priorities -

- Close roads in areas where resource damage is presently occurring.
- Stream culvert replacements to accommodate 100 year flood and aquatic wildlife passage.
- Road resurfacing on riparian 'open' roads currently lacking sufficient rock depth and other improvements to prevent erosion.
- Ensure Maintenance Level "2" roads have drainage devices installed that do not require routine maintenance (drain dips, etc...) .

Implementation shall occur as stated in this plan or as budgets dictate.

IV. SOUTH VALLEY RESOURCE AREA - TRANSPORTATION PLAN

Don Meckley, South Valley Resource Area Engineer

Phase I

Existing Road Inventory	Appendix 'G'
Existing Road Control Map	Appendix 'H'

APPROVAL

Approved by:

Diana Bus

Diana Bus
Acting Coast Range Field Manager

9/13/00
Date:

Steve Calish
South Valley Field Manager

9/18/00
Date:

LONG TOM WATERSHED
TRANSPORTATION MANAGEMENT OBJECTIVES
REVIEW CHECKLIST

NAME	Signature/Date	Position
Graham Armstrong	Graham L Armstrong	Hydrology
Russell Hammer	Russel A Hammer	Fisheries
Gary Hoppe	Gary Hoppe	Landscape Planner
David Huber	David Huber	Wildlife
Eric Meyers	Eric J. Meyers	Coast Range Engineering
Saundra Miles	Saundra Miles	Recreation
Kathy Pendergrass	Kathy J. Pendergrass	Botany
Phil Redlinger	Phillip A. Redlinger	Forestry/Silvicuture
David Reed	David C. Reed	Fire/Fuels
Mark Stephen	Mark Stephen	Ecology
Gary Wilkinson	Gary Wilkinson	GIS
Don Meckley	Donald W. Meckley	South Valley Engineering

LONG TOM TRANSPORTATION PLAN
EXISTING MAINTENANCE LEVELS

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
14-6-34	F	POPE & TALBOT	0.73	ASC	3	BP	Y	MAT	
14-6-34	H	POPE & TALBOT	0.54	ASC	3	BP	Y	MAT	
15-6-08.01			1.62	NAT	2	BP	N	MAT	
15-6-09.02			0.76	ASC	2	BR	N	MAT	
15-6-09.03	B	STARKER SPUR	0.09	ASC	2	BR	N	MAT	
15-6-09.04	A1		0.39	ASC	2	BR	N	MAT	
15-6-09.04	A2		0.53	NAT	2	BR	N	MAT	
15-6-09.05			0.44	ASC	2	BR	N	MAT	
15-6-15	B		0.59	NAT	1	NO	N	MAT	
15-6-15.02	B		0.08	NAT	2	BR	Y	MAT	
15-6-21		LEIMAN RD	0.36	ASC	3	BP	Y	MAT	
15-6-21		LEIMAN RD	1.42	ASC	3	BP	N	MAT	
15-6-21.01	A		1.18	ASC	3	BP	N	MAT	
15-6-21.01	B		0.28	ASC	3	BP	N	MAT	
15-6-21.02			0.33	ASC	2	BP	N	MAT	
15-6-21.03			0.36	ASC	2	BP	N	MAT	
15-6-21.04			0.19	ASC	2	BP	N	MAT	
15-6-21.05			0.15	ASC	2	BP	N	MAT	
15-6-21.06			0.16	ASC	2	BP	N	MAT	
15-6-21.07			0.15	ASC	2	BP	N	MAT	
15-6-26	A	FERGUSON ROAD	0.47	BST	4	BP	Y	MAT	
15-6-26	B	FERGUSON ROAD	0.05	BST	4	BP	Y	MAT	
15-6-26	C	FERGUSON ROAD	0.83	BST	4	BP	Y	MAT	
15-6-26	D	FERGUSON ROAD	0.69	BST	4	BP	Y	MAT	
15-6-26	E	FERGUSON ROAD	0.46	BST	4	BP	Y	MAT	
15-6-26	F	FERGUSON ROAD	0.5	BST	4	BP	Y	MAT	
15-6-26	G	FERGUSON ROAD	0.1	BST	4	BP	Y	MAT	
15-6-26	H	FERGUSON ROAD	0.24	BST	4	BP	Y	MAT	
15-6-26.01			0.45	ASC	2	BP	N	MAT	
15-6-26.02			1.49	ASC	3	BP	N	MAT	
15-6-27			1.1	ASC	3	BP	N	MAT	
15-6-27.01			0.65	ASC	2	BP	N	MAT	
15-6-27.02			0.1	ASC	2	BP	N	MAT	
15-6-27.03	A		0.09	ASC	2	BP	N	MAT	
15-6-27.04			0.55	ASC	2	BP	N	MAT	
15-6-27.05			0.54	ASC	2	BP	N	MAT	
15-6-33	B		0.23	NAT	1	BP	N	MAT	
15-6-33.01	A	VANDEE ROAD	0.4	ASC	4	BP	Y	MAT	
15-6-33.01	B	VANDEE ROAD	0.37	ASC	4	BP	Y	MAT	
15-6-33.01	C	VANDEE ROAD	0.36	ASC	4	BP	Y	MAT	
15-6-33.01	D	VANDEE ROAD	0.08	ASC	2	BP	Y	MAT	
15-6-33.01	E	VANDEE ROAD	0.29	ASC	2	BP	Y	MAT	
15-6-33.01	F	VANDEE ROAD	0.27	ASC	2	BP	Y	MAT	

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
15-6-33.02	A		0.25	NAT	1	BP	N	LSR	
15-6-33.03	A		0.1	NAT	2	BP	N	LSR	
15-6-33.04	A		0.12	NAT	2	BP	N	MAT	
15-6-33.05		OWENS CREEK	0.9	ASC	2	BP	N	MAT	
15-6-33.06		OWENS CREEK	0.12	ASC	2	BP	N	MAT	
16-5-07	B		0.26	NAT	1	NO	N	LSR	
16-6-01			0.5	ASC	2	BP	N	MAT	
16-6-02	A		0.26	ASC	2	BP	Y	MAT	
16-6-02	B		0.59	NAT	2	BP	N	MAT	
16-6-02.01	A2		0.29	NAT	1	NO	N	MAT	
16-6-02.02	A2		0.9	ASC	2	BA	N	L&M	
16-6-03.01			0.08	ASC	2	BA	N	LSR	
16-6-03.02	A		0.22	ASC	2	BA	N	LSR	
16-6-03.03	A		0.11	ASC	2	BA	N	LSR	
16-6-03.04	A		0.48	ASC	2	BA	N	LSR	
16-6-03.05	A		0.21	ASC	2	BA	N	LSR	
16-6-05			0.26	ASC	2	BP	N	LSR	
16-6-05.01			0.11	ASC	2	BP	N	LSR	
16-6-05.02			0.1	ASC	2	BP	N	LSR	
16-6-05.03	A		0.38	ASC	2	BP	N	LSR	
16-6-05.04			0.19	ASC	2	BP	N	LSR	
16-6-05.05			0.12	ASC	2	BP	N	LSR	
16-6-05.06			0.24	ASC	2	BR	N	LSR	
16-6-06	B		0.45	ASC	2	BR	Y	LSR	
16-6-07.01	A	DUMP RUN	0.97	ASC	3	BP	Y	LSR	
16-6-07.02	A		0.84	ASC	2	BR	Y	LSR	
16-6-07.03	A		0.59	NAT	2	BR	N	LSR	
16-6-08	B		0.15	ASC	2	BP	N	LSR	
16-6-08	C		0.62	ASC	2	BP	N	LSR	
16-6-08.02	A		0.14	ASC	2	BP	Y	LSR	
16-6-09	A		2.08	ASC	3	BP	N	LSR	
16-6-09.01			0.09	ASC	2	BP	N	LSR	
16-6-09.02	A		0.08	ASC	2	BP	N	LSR	
16-6-09.03	A		0.95	ASC	3	BP	N	LSR	
16-6-09.04	A		0.18	ASC	2	BP	N	LSR	
16-6-09.05	A		0.17	ASC	2	BP	N	LSR	
16-6-09.06			0.18	ASC	2	BP	N	LSR	
16-6-09.07			0.18	ASC	2	BP	N	LSR	
16-6-09.08			0.24	ASC	2	BP	N	LSR	
16-6-11.01	B		0.3	NAT	2	BA	Y	MAT	
16-6-11.02			0.36	NAT	2	BA	N	MAT	
16-6-11.03			0.38	NAT	2	BA	N	MAT	
16-6-15	B		0.14	NAT	1	NO	N	MAT	
16-6-17	A1	SHELL STATION	0.25	BST	4	BP	Y	LSR	
16-6-17	A2	SHELL STATION	0.51	ASC	4	BP	Y	LSR	
16-6-17	B	SHELL STATION	0.46	ASC	4	BP	Y	LSR	
16-6-17	C	SHELL STATION	0.39	ASC	4	BP	Y	LSR	
16-6-17	D	SHELL STATION	0.31	ASC	4	BP	Y	LSR	

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
16-6-17	E	SHELL STATION	0.48	ASC	4	BP	Y	LSR	
16-6-17	F	SHELL STATION	0.47	ASC	4	BP	Y	LSR	
16-6-17	G	SHELL STATION	0.52	ASC	4	BP	Y	LSR	
16-6-17	H	SHELL STATION	0.35	ASC	4	BP	Y	LSR	
16-6-17.01	A		0.06	NAT	2	BR	Y	LSR	
16-6-17.02			0.38	ASC	3	BP	Y	LSR	
16-6-17.03	A		0.26	ASC	2	BP	Y	LSR	
16-6-17.04			0.24	NAT	2	BP	Y	LSR	
16-6-17.05			0.27	ASC	2	BP	Y	LSR	
16-6-19			2.34	ASC	3	BP	N	MAT	
16-6-19.01			0.54	ASC	2	BP	N	MAT	
16-6-19.02	A		0.6	ASC	2	BP	N	MAT	
16-6-19.03	A		0.1	ASC	2	BP	N	MAT	
16-6-19.04	A		0.25	NAT	2	BP	N	MAT	
16-6-20	A	VIK ROAD	0.08	BST	4	BP	Y	MAT	
16-6-20	B1	VIK ROAD	0.22	BST	4	BP	Y	MAT	
16-6-20	B2	VIK ROAD	0.48	ASC	4	BP	Y	MAT	
16-6-20	C	VIK ROAD	0.08	ASC	4	BP	Y	MAT	
16-6-20	D	VIK ROAD	0.49	ASC	2	BP	Y	MAT	
16-6-20	E	VIK ROAD	0.08	ASC	2	BP	Y	MAT	
16-6-20	F	VIK ROAD	0.61	ASC	2	BP	Y	MAT	
16-6-20.01	B		0.16	ASC	3	BA	N	LSR	
16-6-20.01	C		0.12	ASC	3	BA	N	LSR	
16-6-20.01	D		0.11	ASC	3	BA	N	LSR	
16-6-20.01	E		0.14	ASC	3	BA	N	LSR	
16-6-26	B		0.12	NAT	2	BA	N	MAT	
16-6-28	D	ALDERWOOD RD	0.51	NAT	2	BR	N	MAT	
16-6-31		FISK ROAD	3.07	ASC	4	BP	Y	MAT	
16-6-33.01			0.38	ASC	2	BA	N	L&M	
16-6-33.02			0.05	ASC	2	BA	N	L&M	
16-6-33.03			0.18	ASC	2	BA	Y	L&M	
16-6-33.04			0.08	ASC	2	BA	Y	L&M	
16-7-01			0.82	ASC	2	BP	Y	LSR	
16-7-01.01	A		0.2	NAT	2	BP	N	LSR	
16-7-01.02			0.1	ASC	2	BP	N	LSR	
16-7-01.03	A		0.16	ASC	2	BP	N	LSR	
16-7-12	A2		0.71	ASC	2	BP	N	LSR	
16-7-12	B	NELSON RIDGE	0.58	ASC	4	BP	Y	LSR	
16-7-12	C	NELSON RIDGE	0.55	ASC	4	BP	Y	LSR	
16-7-12	D	NELSON RIDGE	0.28	ASC	4	BP	Y	LSR	
16-7-12	E	NELSON RIDGE	1.14	ASC	4	BP	Y	LSR	
16-7-13		VIK/ BEAR CONN.	1	ASC	3	BP	Y	LSR	
16-7-13.01			0.4	ASC	2	BP	N	LSR	
16-7-13.02			0.09	ASC	2	BP	N	LSR	
16-7-13.03			0.37	ASC	2	BP	N	LSR	
16-7-13.04	A		0.05	ASC	2	BP	N	LSR	
16-7-23	B		0.3	ASC	3	BP	Y	MAT	
16-7-23	C		0.26	ASC	3	BP	Y	MAT	

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
16-7-23	F		0.82	ASC	3	BP	Y	MAT	
16-7-23.02			1	NAT	2	BP	Y	MAT	
16-7-25	A		1.62	ASC	3	BP	N	MAT	
16-7-25.01	A		0.3	NAT	1	BP	N	MAT	
16-7-25.02	A		0.4	ASC	2	BP	N	MAT	
16-7-25.03	A		0.7	ASC	2	BR	N	MAT	
16-7-26			0.32	NAT	2	BR	N	MAT	
16-7-34.01	C		0.33	NAT	2	BR	N	MAT	
16-7-35.01	A		0.49	ASC	2	BP	N	CON	
16-7-35.02	A		0.28	ASC	2	BP	N	CON	
17-6-04	B	REINSCHE ROAD	0.54	ASC	2	BA	Y	L&M	
17-6-04	D	REINSCHE ROAD	0.23	ASC	2	BA	N	L&M	
17-6-18		KOOZER/PRICE RD	2.02	ASC	3	BP	N	MAT	
17-6-30	B		0.28	NAT	2	BA	N	MAT	
17-6-30.01	A	TORRENCE ROAD	0.27	ASC	2	BP	Y	LSR	
17-6-30.01	B	TORRENCE ROAD	0.38	ASC	2	BP	Y	LSR	
17-6-30.01	C	TORRENCE ROAD	0.47	ASC	2	BP	N	LSR	
17-7-01	A		1.27	ASC	3	BP	Y	MAT	
17-7-01	B		0.69	ASC	3	BP	Y	MAT	
17-7-01	C		1.24	ASC	3	BP	Y	MAT	
17-7-01.01	A		0.05	NAT	2	BP	Y	LSR	
17-7-01.03	A		0.12	NAT	2	BP	Y	LSR	
17-7-01.03	C		0.59	NAT	2	NO	Y	LSR	
17-7-01.03	D		0.4	NAT	2	NO	Y	LSR	
17-7-02	B		0.66	NAT	2	BP	N	CON	
17-7-02	C		0.95	NAT	2	BP	N	CON	
17-7-02	E		0.15	NAT	2	BP	N	CON	
17-7-02.01	B		1.12	NAT	2	NO	N	MAT	
17-7-09	C	IRON MOUNTAIN	0.41	ASC	3	BR	Y	LSR	
17-7-09	D	IRON MOUNTAIN	0.3	ASC	3	BR	Y	LSR	
17-7-09	E	IRON MOUNTAIN	0.41	ASC	3	BR	Y	LSR	
17-7-09	F	IRON MOUNTAIN	0.12	ASC	3	BR	Y	LSR	
17-7-09	G	IRON MOUNTAIN	0.18	ASC	2	BR	N	LSR	
17-7-10	A1		0.08	ASC	2	BR	N	LSR	
17-7-10	A2		0.12	NAT	2	BR	N	LSR	
17-7-11	A		0.6	NAT	1	NO	N	LSR	
17-7-13	B		0.13	NAT	1	NO	N	LSR	
17-7-13	D		1.1	NAT	1	BR	N	LSR	
17-7-13.01	B		0.12	NAT	1	NO	N	LSR	
17-7-13.02			0.23	ASC	2	BP	N	LSR	
17-7-13.03			0.15	ASC	2	BP	N	LSR	
17-7-13.04			0.58	ASC	3	BP	N	LSR	
17-7-13.05			0.2	ASC	2	BP	N	LSR	
17-7-13.06			0.05	ASC	2	BP	N	LSR	
17-7-15	A		0.5	NAT	2	BP	N	LSR	
17-7-15.01	A		0.15	ASC	2	BP	N	LSR	
17-7-21.01	A		0.34	NAT	2	BP	Y	MAT	
17-7-21.02	B		0.2	ASC	2	BR	Y	MAT	

BEST COPY AVAILABLE

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
17-7-21.02	D		0.44	ASC	2	BR	Y	MAT	
17-7-22	A1	IP DEEDED RD.	0.35	BST	4	BP	Y	L&M	
17-7-22	A2	IP DEEDED RD.	0.55	ASC	4	BP	Y	L&M	
17-7-22	B	IP DEEDED RD.	0.38	ASC	4	BP	Y	L&M	
17-7-22	C	IP DEEDED RD.	0.37	ASC	4	BP	Y	L&M	
17-7-22	D	IP DEEDED RD.	0.17	ASC	4	BP	Y	L&M	
17-7-22	E	IP DEEDED RD.	1.23	ASC	4	BP	Y	L&M	
17-7-22	F	IP DEEDED RD.	0.51	ASC	4	BP	Y	L&M	
17-7-22	G	IP DEEDED RD.	1.29	ASC	4	BP	Y	L&M	
17-7-22	H	IP DEEDED RD.	0.62	ASC	4	BP	Y	L&M	
17-7-22	I	IP DEEDED RD.	0.48	ASC	4	BP	Y	L&M	
17-7-22	J	IP DEEDED RD.	0.9	ASC	4	BP	Y	L&M	
17-7-22	K	IP DEEDED RD.	0.9	ASC	4	BP	Y	L&M	
17-7-22.01	A		0.15	NAT	2	BP	Y	MAT	
17-7-22.01	B		0.14	NAT	2	BP	N	MAT	
17-7-22.02	A3		0.3	NAT	1	NO	N	LSR	
17-7-22.03	B		0.72	NAT	2	NO	N	LSR	
17-7-22.04	B		1.2	NAT	2	BP	N	MAT	
17-7-22.05	A		0.58	NAT	2	BP	N	MAT	
17-7-22.06			0.1	ASC	2	BP	N	LSR	
17-7-27	A		0.34	ASC	3	BP	Y	MAT	
17-7-27	B		0.08	ASC	3	BP	Y	MAT	
17-7-27	C		0.02	ASC	3	BP	Y	MAT	
17-7-27	D		1.36	ASC	3	BP	Y	MAT	
17-7-34	B		0.66	ASC	2	BR	Y	MAT	
17-7-34.02	A		0.12	NAT	1	BR	N	MAT	OBLITERATED
17-7-34.02	B		0.09	ASC	2	BR	Y	MAT	
17-7-34.02	C		0.12	ASC	2	BR	Y	MAT	
17-7-34.02	D		0.02	NAT	1	BR	Y	MAT	
17-7-34.02	F		0.25	NAT	2	BR	N	MAT	
17-7-35	A	BADGER MTN RD	0.77	NAT	2	BR	Y	MAT	
17-7-35.02			0.69	NAT	2	BR	N	MAT	
17-7-35.03			0.22	NAT	2	BR	N	MAT	
17-7-36	B		0.37	NAT	2	BR	N	MAT	
18-6-03.01	A		0.15	ASC	2	BR	N	MAT	
18-6-05	A	JORGENSON RD.	1.99	ASC	3	BR	Y	L&M	
18-6-05	B	JORGENSON RD.	1.5	ASC	3	BR	Y	L&M	
18-6-05	C	JORGENSON RD.	0.53	ASC	3	BR	Y	L&M	
18-6-05.03	A		0.26	ASC	2	BR	Y	LSR	
18-6-05.05	B		0.4	NAT	2	BR	N	LSR	
18-6-05.05	C		0.1	NAT	2	BR	N	LSR	
18-6-05.06			0.17	NAT	2	BR	Y	LSR	
18-6-08	B		0.05	ASC	3	BR	Y	MAT	RRC MAINT
18-6-08	D		0.71	ASC	3	BR	Y	MAT	RRC MAINT
18-6-08.05	B	HARDY CREEK	1.02	ASC	2	BR	N	MAT	
18-6-09.06	B		0.05	NAT	1	BR	N	MAT	
18-6-11		BOLTON HILL	1.02	ASC	2	BP	Y	MAT	
18-6-11.01			0.11	ASC	2	BP	N	MAT	

ROAD NO.	SEG	ROAD NAME	MILE	SURF	ML	ACCESS	SHARED?	LUA	REMARKS
18-6-14			0.47	NAT	1	NO	N	LSR	
18-6-17			1.01	ASC	2	BR	N	MAT	
18-6-18.12	B		0.04	NAT	2	BR	N	MAT	
18-6-21.04			0.32	NAT	1	BP	N	LSR	
18-6-27.01			0.35	ASC	2	BR	N	LSR	
18-6-27.02			0.54	ASC	2	BR	N	LSR	
TOTALS:			110.2						

LONG TOM TRANSPORTATION PLAN - HUMAN USES RATING

ROAD NO.	SEG	MILE	SHARED?	TIMBER USE	SILVICULT. USE	PRIVATE ACCESS	PUBLIC ACCESS	RECREATE USE	HUMAN USE RATING
14-6-34	F	0.73	Y	5	5	4	4	3	H
14-6-34	H	0.54	Y	5	5	4	4	3	H
15-6-08.01		1.62	N	5	1	1	2	1	L
15-6-09.02		0.76	N	1	5	1	2	1	L
15-6-09.03	B	0.09	N	1	5	1	2	1	L
15-6-09.04	A1	0.39	N	1	5	1	2	1	L
15-6-09.04	A2	0.53	N	1	1	1	1	1	L
15-6-09.05		0.44	N	1	1	1	2	1	L
15-6-15	B	0.59	N	3	1	3	1	1	L
15-6-15.02	B	0.08	Y	1	1	5	1	1	H
15-6-21		0.36	Y	1	5	5	2	2	H
15-6-21		1.42	N	1	5	1	2	2	L
15-6-21.01	A	1.18	N	1	5	1	2	2	L
15-6-21.01	B	0.28	N	1	1	1	2	2	L
15-6-21.02		0.33	N	1	1	1	2	2	L
15-6-21.03		0.36	N	1	1	1	2	1	L
15-6-21.04		0.19	N	1	5	1	2	1	L
15-6-21.05		0.15	N	1	1	1	2	1	L
15-6-21.06		0.16	N	1	1	1	2	1	L
15-6-21.07		0.15	N	1	5	1	2	1	L
15-6-26	A	0.47	Y	5	5	5	4	3	H
15-6-26	B	0.05	Y	5	5	5	4	3	H
15-6-26	C	0.83	Y	5	5	5	4	3	H
15-6-26	D	0.69	Y	5	5	5	4	3	H
15-6-26	E	0.46	Y	5	5	5	4	3	H
15-6-26	F	0.5	Y	5	5	5	4	3	H
15-6-26	G	0.1	Y	5	5	5	4	3	H
15-6-26	H	0.24	Y	5	5	5	4	3	H
15-6-26.01		0.45	N	1	1	1	1	2	L
15-6-26.02		1.49	N	1	5	1	2	3	M
15-6-27		1.1	N	1	1	1	2	3	L
15-6-27.01		0.65	N	1	1	1	2	3	L
15-6-27.02		0.1	N	1	1	1	2	3	L
15-6-27.03	A	0.09	N	1	1	1	2	3	L
15-6-27.04		0.55	N	1	5	1	2	3	M
15-6-27.05		0.54	N	1	5	1	2	1	L
15-6-33	B	0.23	N	1	1	3	1	2	L
15-6-33.01	A	0.4	Y	5	5	5	4	3	H
15-6-33.01	B	0.37	Y	5	5	5	4	3	H
15-6-33.01	C	0.36	Y	5	5	5	4	3	H
15-6-33.01	D	0.08	Y	1	1	5	2	2	H

ROAD NO.	SEG	MILE	SHARED?	TIMBER	SILVICULT.	PRIVATE	PUBLIC	RECREATE	HUMAN
15-6-33.01	E	0.29	Y	1	1	5	2	2	H
15-6-33.01	F	0.27	Y	1	1	5	2	2	H
15-6-33.02	A	0.25	N	1	1	2	1	1	L
15-6-33.03	A	0.1	N	1	1	5	2	1	H
15-6-33.04	A	0.12	N	1	1	1	2	1	L
15-6-33.05		0.9	N	1	5	1	2	1	L
15-6-33.06		0.12	N	1	1	1	2	1	L
16-5-07	B	0.26	N	1	1	1	1	1	L
16-6-01		0.5	N	1	5	1	2	1	H
16-6-02	A	0.26	Y	5	5	5	2	1	H
16-6-02	B	0.59	N	5	5	1	2	1	M
16-6-02.01	A2	0.29	N	1	1	2	1	1	L
16-6-02.02	A2	0.9	N	1	5	1	2	1	L
16-6-03.01		0.08	N	1	1	1	1	1	L
16-6-03.02	A	0.22	N	1	1	1	1	1	L
16-6-03.03	A	0.11	N	1	1	1	1	1	L
16-6-03.04	A	0.48	N	1	1	1	1	1	L
16-6-03.05	A	0.21	N	1	1	1	1	3	L
16-6-05		0.26	N	1	1	1	2	3	L
16-6-05.01		0.11	N	1	1	1	2	3	L
16-6-05.02		0.1	N	1	1	1	2	3	L
16-6-05.03	A	0.38	N	1	1	1	2	3	L
16-6-05.04		0.19	N	1	1	1	2	3	L
16-6-05.05		0.12	N	1	1	1	2	3	L
16-6-05.06		0.24	N	1	1	1	2	3	L
16-6-06	B	0.45	Y	1	1	5	1	3	L
16-6-07.01	A	0.97	Y	1	1	5	1	3	H
16-6-07.02	A	0.84	Y	1	1	1	2	3	L
16-6-07.03	A	0.59	N	1	1	1	1	3	L
16-6-08	B	0.15	N	1	1	1	2	3	L
16-6-08	C	0.62	N	1	1	1	2	3	L
16-6-08.02	A	0.14	Y	1	1	1	2	3	L
16-6-09	A	2.08	N	1	5	1	2	3	M
16-6-09.01		0.09	N	1	1	1	2	3	L
16-6-09.02	A	0.08	N	1	1	1	2	3	L
16-6-09.03	A	0.95	N	1	5	1	2	3	L
16-6-09.04	A	0.18	N	1	1	1	2	3	L
16-6-09.05	A	0.17	N	1	1	1	2	3	L
16-6-09.06		0.18	N	1	1	1	2	3	L
16-6-09.07		0.18	N	1	1	1	2	3	L
16-6-09.08		0.24	N	1	1	1	2	3	L
16-6-11.01	B	0.3	Y	5	5	5	2	1	H
16-6-11.02		0.36	N	5	5	1	1	1	M
16-6-11.03		0.38	N	5	5	1	1	1	M
16-6-15	B	0.14	N	1	1	1	1	1	L
16-6-17	A1	0.25	Y	5	5	5	4	3	H
16-6-17	A2	0.51	Y	5	5	5	4	3	H
16-6-17	B	0.46	Y	5	5	5	4	3	H

ROAD NO.	SEG	MILE	SHARED?	TIMBER	SILVICULT.	PRIVATE	PUBLIC	RECREATE	HUMAN
16-6-17	C	0.39	Y	5	5	5	4	3	H
16-6-17	D	0.31	Y	5	5	5	4	3	H
16-6-17	E	0.48	Y	5	5	5	4	3	H
16-6-17	F	0.47	Y	5	5	5	4	3	H
16-6-17	G	0.52	Y	5	5	5	4	3	H
16-6-17	H	0.35	Y	5	5	5	4	3	H
16-6-17.01	A	0.06	Y	1	1	5	2	3	H
16-6-17.02		0.38	Y	1	1	5	2	3	H
16-6-17.03	A	0.26	Y	1	1	4	2	3	L
16-6-17.04		0.24	Y	1	1	4	2	3	L
16-6-17.05		0.27	Y	1	1	1	2	3	L
16-6-19		2.34	N	5	5	3	3	3	H
16-6-19.01		0.54	N	1	1	1	2	1	L
16-6-19.02	A	0.6	N	1	1	1	2	1	L
16-6-19.03	A	0.1	N	1	1	1	2	1	L
16-6-19.04	A	0.25	N	1	1	1	1	1	L
16-6-20	A	0.08	Y	1	1	5	3	3	H
16-6-20	B1	0.22	Y	1	1	5	3	3	H
16-6-20	B2	0.48	Y	1	1	5	3	3	H
16-6-20	C	0.08	Y	1	1	5	3	3	H
16-6-20	D	0.49	Y	1	1	5	2	1	H
16-6-20	E	0.08	Y	1	1	5	2	1	H
16-6-20	F	0.61	Y	1	1	5	2	1	H
16-6-20.01	B	0.16	N	1	1	5	2	3	M
16-6-20.01	C	0.12	N	1	1	4	2	3	M
16-6-20.01	D	0.11	N	1	1	4	2	3	M
16-6-20.01	E	0.14	N	1	1	1	2	3	L
16-6-26	B	0.12	N	1	1	1	2	1	L
16-6-28	D	0.51	N	1	1	1	1	1	L
16-6-31		3.07	Y	5	5	5	4	3	H
16-6-33.01		0.38	N	1	1	1	1	1	L
16-6-33.02		0.05	N	1	1	1	1	1	L
16-6-33.03		0.18	Y	1	1	5	1	1	H
16-6-33.04		0.08	Y	1	1	5	1	1	H
16-7-01		0.82	Y	1	1	1	2	3	L
16-7-01.01	A	0.2	N	1	1	1	1	3	L
16-7-01.02		0.1	N	1	1	1	2	3	L
16-7-01.03	A	0.16	N	1	1	1	2	3	L
16-7-12	A2	0.71	N	1	5	1	2	3	M
16-7-12	B	0.58	Y	5	5	5	4	3	H
16-7-12	C	0.55	Y	5	5	5	4	3	H
16-7-12	D	0.28	Y	5	5	5	4	3	H
16-7-12	E	1.14	Y	5	5	5	4	3	H
16-7-13		1	Y	5	5	3	3	3	H
16-7-13.01		0.4	N	1	1	1	2	2	L
16-7-13.02		0.09	N	1	1	1	2	2	L
16-7-13.03		0.37	N	1	1	1	2	2	L
16-7-13.04	A	0.05	N	1	5	1	2	2	L

ROAD NO.	SEG	MILE	SHARED?	TIMBER	SILVICULT.	PRIVATE	PUBLIC	RECREATE	HUMAN
16-7-23	B	0.3	Y	5	3	5	2	3	H
16-7-23	C	0.26	Y	5	3	5	2	3	H
16-7-23	F	0.82	Y	5	3	5	2	3	H
16-7-23.02		1	Y	5	5	5	2	1	H
16-7-25	A	1.62	N	5	5	1	2	2	M
16-7-25.01	A	0.3	N	1	1	1	1	1	L
16-7-25.02	A	0.4	N	1	1	1	2	1	L
16-7-25.03	A	0.7	N	1	1	1	2	2	L
16-7-26		0.32	N	1	1	1	2	1	L
16-7-34.01	C	0.33	N	1	1	1	1	1	L
16-7-35.01	A	0.49	N	1	1	1	2	1	L
16-7-35.02	A	0.28	N	1	1	1	2	1	L
17-6-04	B	0.54	Y	5	5	5	2	2	H
17-6-04	D	0.23	N	5	5	5	2	2	H
17-6-18		2.02	N	1	5	1	2	2	L
17-6-30	B	0.28	N	1	5	1	1	1	L
17-6-30.01	A	0.27	Y	1	1	5	2	3	H
17-6-30.01	B	0.38	Y	1	1	1	2	1	L
17-6-30.01	C	0.47	N	1	1	1	2	1	L
17-7-01	A	1.27	Y	5	5	4	3	2	H
17-7-01	B	0.69	Y	1	3	4	3	2	M
17-7-01	C	1.24	Y	1	3	3	3	2	M
17-7-01.01	A	0.05	Y	1	1	5	1	1	H
17-7-01.03	A	0.12	Y	1	1	5	2	1	H
17-7-01.03	C	0.59	Y	1	1	5	2	1	H
17-7-01.03	D	0.4	Y	1	1	5	2	1	H
17-7-02	B	0.66	N	1	1	2	2	1	L
17-7-02	C	0.95	N	1	1	2	2	1	L
17-7-02	E	0.15	N	1	1	2	2	1	L
17-7-02.01	B	1.12	N	1	1	1	1	1	L
17-7-09	C	0.41	Y	5	5	5	2	1	H
17-7-09	D	0.3	Y	5	5	5	2	1	H
17-7-09	E	0.41	Y	5	5	5	2	1	H
17-7-09	F	0.12	Y	5	5	5	2	1	H
17-7-09	G	0.18	N	1	1	1	2	1	L
17-7-10	A1	0.08	N	5	5	1	2	1	M
17-7-10	A2	0.12	N	5	5	1	2	1	M
17-7-11	A	0.6	N	1	1	1	1	1	L
17-7-13	B	0.13	N	1	1	2	1	1	L
17-7-13	D	1.1	N	1	1	2	1	1	L
17-7-13.01	B	0.12	N	1	1	1	1	1	L
17-7-13.02		0.23	N	1	1	1	2	1	L
17-7-13.03		0.15	N	1	1	1	2	1	L
17-7-13.04		0.58	N	1	1	1	2	1	L
17-7-13.05		0.2	N	1	1	1	2	1	L
17-7-13.06		0.05	N	1	1	1	2	1	L
17-7-15	A	0.5	N	1	1	2	1	1	L
17-7-15.01	A	0.15	N	1	1	1	1	1	L

ROAD NO.	SEG	MILE	SHARED?	TIMBER	SILVICULT.	PRIVATE	PUBLIC	RECREATE	HUMAN
17-7-21.01	A	0.34	Y	5	5	5	2	2	H
17-7-21.02	B	0.2	Y	5	5	5	2	2	H
17-7-21.02	D	0.44	Y	5	5	5	2	2	H
17-7-22	A1	0.35	Y	5	5	5	4	3	H
17-7-22	A2	0.55	Y	5	5	5	4	3	H
17-7-22	B	0.38	Y	5	5	5	4	3	H
17-7-22	C	0.37	Y	5	5	5	4	3	H
17-7-22	D	0.17	Y	5	5	5	4	3	H
17-7-22	E	1.23	Y	5	5	5	4	3	H
17-7-22	F	0.51	Y	5	5	5	4	3	H
17-7-22	G	1.29	Y	5	5	5	4	3	H
17-7-22	H	0.62	Y	5	5	5	4	3	H
17-7-22	I	0.48	Y	5	5	5	4	3	H
17-7-22	J	0.9	Y	5	5	5	4	3	H
17-7-22	K	0.9	Y	5	5	5	4	3	H
17-7-22.01	A	0.15	Y	1	1	4	2	1	L
17-7-22.01	B	0.14	N	1	1	1	2	1	L
17-7-22.02	A3	0.3	N	1	1	1	1	1	L
17-7-22.03	B	0.72	N	1	1	1	1	1	L
17-7-22.04	B	1.2	N	1	1	2	1	1	L
17-7-22.05	A	0.58	N	1	1	2	2	1	L
17-7-22.06		0.1	N	1	1	1	1	1	L
17-7-27	A	0.34	Y	5	5	5	3	2	H
17-7-27	B	0.08	Y	5	5	5	3	2	H
17-7-27	C	0.02	Y	5	5	5	3	2	H
17-7-27	D	1.36	Y	5	5	5	3	2	H
17-7-34	B	0.66	Y	5	5	5	2	3	H
17-7-34.02	A	0.12	N	1	1	1	1	1	L
17-7-34.02	B	0.09	Y	1	1	5	2	1	H
17-7-34.02	C	0.12	Y	1	1	5	2	1	H
17-7-34.02	D	0.02	Y	1	1	5	2	1	H
17-7-34.02	F	0.25	N	1	1	1	2	1	L
17-7-35	A	0.77	Y	5	5	3	2	3	H
17-7-35.02		0.69	N	5	5	1	1	1	M
17-7-35.03		0.22	N	5	5	1	1	1	M
17-7-36	B	0.37	Y	1	1	1	2	2	L
18-6-03.01	A	0.15	N	1	1	4	2	1	L
18-6-05	A	1.99	Y	5	5	5	3	2	H
18-6-05	B	1.5	Y	5	5	5	3	2	H
18-6-05	C	0.53	Y	5	5	5	3	2	H
18-6-05.03	A	0.26	Y	1	1	5	2	2	H
18-6-05.05	B	0.4	N	1	1	2	2	1	L
18-6-05.05	C	0.1	N	1	1	2	2	1	L
18-6-05.06		0.17	Y	1	1	5	2	1	L
18-6-08	B	0.05	Y	5	5	5	3	3	H
18-6-08	D	0.71	Y	5	5	5	3	3	H
18-6-08.05	B	1.02	N	1	1	1	2	1	L
18-6-09.06	B	0.05	N	1	1	1	2	1	L

ROAD NO.	SEG	MILE	SHARED?	TIMBER	SILVICULT.	PRIVATE	PUBLIC	RECREATE	HUMAN
18-6-11		1.02	Y	5	5	5	2	1	H
18-6-11.01		0.11	N	5	5	1	2	1	M
18-6-14		0.47	N	1	1	1	1	1	L
18-6-17		1.01	N	1	1	1	2	1	L
18-6-18.12	B	0.04	N	1	1	1	2	1	L
18-6-21.04		0.32	N	1	1	1	1	1	L
18-6-27.01		0.35	N	1	1	1	2	1	L
18-6-27.02		0.54	N	1	1	1	2	1	L
TOTALS:		110.2							

LONG TOM TRANSPORTATION PLAN - AQUATIC IMPACT RISK RATING

ROAD NO.	SEG	MILE	Risk of Road Failure (1-5)	Risk to Fish Streams (1-5)	Road Sediment (1-5)	Stream rossings (1-5)	Floodplain Channel Dynamics (1-5)	Flow Effects (1-5)	Aquatic Impact Rating	Remarks
14-6-34	F	0.73	1	1	1	1	1	1	LOW	
14-6-34	H	0.54	1	1	1	1	1	1	LOW	
15-6-08.01		1.62	1	1	1	1	1	1	LOW	
15-6-09.02		0.76	1	1	1	1	1	1	LOW	
15-6-09.03	B	0.09	1	1	1	1	1	1	LOW	
15-6-09.04	A1	0.39	1	1	1	1	1	1	LOW	
15-6-09.04	A2	0.53	1	1	1	1	1	1	LOW	
15-6-09.05		0.44	1	1	1	1	1	1	LOW	
15-6-15	B	0.59	1	1	1	1	1	1	LOW	
15-6-15.02	B	0.08	1	1	1	1	1	1	LOW	
15-6-21		0.36	1	1	1	1	1	1	LOW	
15-6-21		1.42	1	1	1	1	1	1	LOW	
15-6-21.01	A	1.18	1	1	1	1	1	1	LOW	
15-6-21.01	B	0.28	1	1	1	1	1	1	LOW	
15-6-21.02		0.33	1	1	1	1	1	1	LOW	
15-6-21.03		0.36	1	1	1	1	1	1	LOW	
15-6-21.04		0.19	1	1	1	1	1	1	LOW	
15-6-21.05		0.15	1	1	1	1	1	1	LOW	
15-6-21.06		0.16	1	1	1	1	1	1	LOW	
15-6-21.07		0.15	1	1	1	1	1	1	LOW	
15-6-26	A	0.47	1	5	1	5	1	1	HIGH	culvert problem
15-6-26	B	0.05	1	1	1	1	1	1	LOW	
15-6-26	C	0.83	1	1	1	1	1	1	LOW	
15-6-26	D	0.69	1	1	1	1	1	1	LOW	
15-6-26	E	0.46	1	1	1	1	1	1	LOW	
15-6-26	F	0.5	1	1	1	1	1	1	LOW	
15-6-26	G	0.1	1	1	1	1	1	1	LOW	
15-6-26	H	0.24	1	1	1	1	1	1	LOW	
15-6-26.01		0.45	1	1	5	1	1	1	HIGH	stream sediment frm orv's
15-6-26.02		1.49	1	5	1	5	1	1	HIGH	riparian road
15-6-27		1.1	1	1	1	1	1	1	LOW	
15-6-27.01		0.65	1	1	1	1	1	1	LOW	
15-6-27.02		0.1	1	1	1	1	1	1	LOW	
15-6-27.03	A	0.09	1	1	1	1	1	1	LOW	
15-6-27.04		0.55	1	1	1	1	1	1	LOW	
15-6-27.05		0.54	1	1	1	1	1	1	LOW	
15-6-33	B	0.23	1	1	1	1	1	1	LOW	
15-6-33.01	A	0.4	1	1	1	1	1	1	LOW	
15-6-33.01	B	0.37	1	1	1	1	1	1	LOW	
15-6-33.01	C	0.36	1	1	1	1	1	1	LOW	
15-6-33.01	D	0.08	1	1	1	1	1	1	LOW	
15-6-33.01	E	0.29	1	1	1	1	1	1	LOW	
15-6-33.01	F	0.27	1	1	1	1	1	1	LOW	
15-6-33.02	A	0.25	1	1	1	1	1	1	LOW	
15-6-33.03	A	0.1	1	1	1	1	1	1	LOW	
15-6-33.04	A	0.12	1	1	1	1	1	1	LOW	
15-6-33.05		0.9	1	1	1	1	1	1	LOW	
15-6-33.06		0.12	1	1	1	1	1	1	LOW	
16-5-07	B	0.26	1	1	1	1	1	1	LOW	
16-6-01		0.5	1	1	1	1	1	1	LOW	
16-6-02	A	0.26	1	1	1	1	1	1	LOW	
16-6-02	B	0.59	1	1	1	1	1	1	LOW	
16-6-02.01	A2	0.29	1	1	1	1	1	1	LOW	

ROAD NO.	SEG	MILE	Risk of	Risk to	Road	Stream	Floodplain	Flow	Aquatic	Remarks
16-6-02.02	A2	0.9	1	1	1	1	1	1	LOW	
16-6-03.01		0.08	1	1	1	1	1	1	LOW	
16-6-03.02	A	0.22	1	1	1	1	1	1	LOW	
16-6-03.03	A	0.11	1	1	1	1	1	1	LOW	
16-6-03.04	A	0.48	1	1	1	1	1	1	LOW	
16-6-03.05	A	0.21	1	1	1	1	1	1	LOW	
16-6-05		0.26	1	1	1	1	1	1	LOW	
16-6-05.01		0.11	1	1	1	1	1	1	LOW	
16-6-05.02		0.1	1	1	1	1	1	1	LOW	
16-6-05.03	A	0.38	1	1	1	1	1	1	LOW	
16-6-05.04		0.19	1	1	1	1	1	1	LOW	
16-6-05.05		0.12	1	1	1	1	1	1	LOW	
16-6-05.06		0.24	1	1	1	1	1	1	LOW	
16-6-06	B	0.45	1	1	1	1	1	1	LOW	
16-6-07.01	A	0.97	1	1	1	1	1	1	LOW	
16-6-07.02	A	0.84	1	1	1	1	1	1	LOW	
16-6-07.03	A	0.59	1	1	1	1	1	1	LOW	
16-6-08	B	0.15	1	1	1	1	1	1	LOW	
16-6-08	C	0.62	1	1	1	1	1	1	LOW	
16-6-08.02	A	0.14	1	1	1	1	1	1	LOW	
16-6-09	A	2.08	1	5	1	5	1	1	HIGH	culvert problem
16-6-09.01		0.09	1	1	1	1	1	1	LOW	
16-6-09.02	A	0.08	1	1	1	1	1	1	LOW	
16-6-09.03	A	0.95	1	1	1	1	1	1	LOW	
16-6-09.04	A	0.18	1	1	1	1	1	1	LOW	
16-6-09.05	A	0.17	1	1	1	1	1	1	LOW	
16-6-09.06		0.18	1	1	1	1	1	1	LOW	
16-6-09.07		0.18	1	1	1	1	1	1	LOW	
16-6-09.08		0.24	1	1	1	1	1	1	LOW	
16-6-11.01	B	0.3	1	1	1	1	1	1	LOW	
16-6-11.02		0.36	1	1	1	1	1	1	LOW	
16-6-11.03		0.38	1	1	1	1	1	1	LOW	
16-6-15	B	0.14	1	1	1	1	1	1	LOW	
16-6-17	A1	0.25	1	1	1	1	1	1	LOW	
16-6-17	A2	0.51	1	1	1	1	1	1	LOW	
16-6-17	B	0.46	1	1	1	1	1	1	LOW	
16-6-17	C	0.39	1	1	1	1	1	1	LOW	
16-6-17	D	0.31	1	1	1	1	1	1	LOW	
16-6-17	E	0.48	1	1	1	1	1	1	LOW	
16-6-17	F	0.47	1	1	1	1	1	1	LOW	
16-6-17	G	0.52	1	1	1	1	1	1	LOW	
16-6-17	H	0.35	1	1	1	1	1	1	LOW	
16-6-17.01	A	0.06	1	1	1	1	1	1	LOW	
16-6-17.02		0.38	1	1	1	1	1	1	LOW	
16-6-17.03	A	0.26	1	1	1	1	1	1	LOW	
16-6-17.04		0.24	1	1	1	1	1	1	LOW	
16-6-17.05		0.27	1	1	1	1	1	1	LOW	
16-6-19		2.34	1	1	1	1	1	1	LOW	
16-6-19.01		0.54	1	1	1	1	1	1	LOW	
16-6-19.02	A	0.6	1	1	1	1	1	1	LOW	
16-6-19.03	A	0.1	1	1	1	1	1	1	LOW	
16-6-19.04	A	0.25	1	1	1	1	1	1	LOW	
16-6-20	A	0.08	1	1	1	1	1	1	LOW	
16-6-20	B1	0.22	1	1	1	1	1	1	LOW	
16-6-20	B2	0.48	1	1	1	1	1	1	LOW	
16-6-20	C	0.08	1	1	1	1	1	1	LOW	
16-6-20	D	0.49	1	1	1	1	1	1	LOW	
16-6-20	E	0.08	1	1	1	1	1	1	LOW	culvert problem
16-6-20	F	0.61	1	1	1	1	1	1	LOW	
16-6-20.01	B	0.16	1	1	1	1	1	1	LOW	

ROAD NO.	SEG	MILE	Risk of	Risk to	Road	Stream	Floodplain	Flow	Aquatic	Remarks	
16-6-20.01	C	0.12	1	1	1	1	1	1	LOW		
16-6-20.01	D	0.11	1	1	1	1	1	1	LOW		
16-6-20.01	E	0.14	1	1	1	1	1	1	LOW		
16-6-26	B	0.12	1	1	1	1	1	1	LOW		
16-6-28	D	0.51	1	1	1	1	1	1	LOW		
16-6-31		3.07	1	1	1	1	1	1	LOW		
16-6-33.01		0.38	1	1	1	1	1	1	LOW		
16-6-33.02		0.05	1	1	1	1	1	1	LOW		
16-6-33.03		0.18	1	1	1	1	1	1	LOW		
16-6-33.04		0.08	1	1	1	1	1	1	LOW		
16-7-01		0.82	1	5	1	5	1	1	HIGH	culvert&orv problems	
16-7-01.01	A	0.2	1	5	1	5	1	1	HIGH	culvert problem	
16-7-01.02		0.1	1	1	1	1	1	1	LOW		
16-7-01.03	A	0.16	1	1	1	1	1	1	LOW		
16-7-12	A2	0.71	1	1	1	1	1	1	LOW		
16-7-12	B	0.58	1	1	1	1	1	1	LOW		
16-7-12	C	0.55	1	1	1	1	1	1	LOW		
16-7-12	D	0.28	1	1	1	1	1	1	LOW		
16-7-12	E	1.14	1	1	1	1	1	1	LOW		
16-7-13		1	1	1	1	1	1	1	LOW		
16-7-13.01		0.4	1	1	1	1	1	1	LOW		
16-7-13.02		0.09	1	1	1	1	1	1	LOW		
16-7-13.03		0.37	1	1	1	1	1	1	LOW		
16-7-13.04	A	0.05	1	1	1	1	1	1	LOW		
16-7-23	B	0.3	1	1	1	1	1	1	LOW		
16-7-23	C	0.26	1	1	1	1	1	1	LOW		
16-7-23	F	0.82	1	1	1	1	1	1	LOW		
16-7-23.02		1	1	1	1	1	1	1	LOW		
16-7-25	A	1.62	1	5	1	5	1	1	HIGH	culvert problem	
16-7-25.01	A	0.3	1	1	1	1	1	1	LOW		
16-7-25.02	A	0.4	1	1	1	1	1	1	LOW		
16-7-25.03	A	0.7	1	1	1	1	1	1	LOW		
16-7-26		0.32	1	1	1	1	1	1	LOW		
16-7-34.01	C	0.33	1	1	1	1	1	1	LOW		
16-7-35.01	A	0.49	1	1	1	1	1	1	LOW		
16-7-35.02	A	0.28	1	1	1	1	1	1	LOW		
17-6-04	B	0.54	1	1	1	1	1	1	LOW		
17-6-04	D	0.23	1	1	1	1	1	1	LOW		
17-6-18		2.02	1	5	1	5	1	1	HIGH	culvert problem	
17-6-30	B	0.28	1	1	1	1	1	1	LOW		
17-6-30.01	A	0.27	1	1	1	1	1	1	LOW		
17-6-30.01	B	0.38	1	1	1	1	1	1	LOW		
17-6-30.01	C	0.47	1	1	1	1	1	1	LOW		
17-7-01	A	1.27	1	1	1	1	1	1	LOW		
17-7-01	B	0.69	1	1	1	1	1	1	LOW		
17-7-01	C	1.24	1	1	1	1	1	1	LOW		
17-7-01.01	A	0.05	1	1	1	1	1	1	LOW		
17-7-01.03	A	0.12	1	1	1	1	1	1	LOW		
17-7-01.03	C	0.59	1	1	1	1	1	1	LOW		
17-7-01.03	D	0.4	1	1	1	1	1	1	LOW		
17-7-02	B	0.66	1	1	1	1	1	1	LOW		
17-7-02	C	0.95	1	1	1	1	1	1	LOW		
17-7-02	E	0.15	1	1	1	1	1	1	LOW		
17-7-02.01	B	1.12	1	1	1	1	1	1	LOW		
17-7-09	C	0.41	1	1	1	1	1	1	LOW		
17-7-09	D	0.3	1	1	1	1	1	1	LOW		
17-7-09	E	0.41	1	1	1	1	1	1	LOW		
17-7-09	F	0.12	1	1	1	1	1	1	LOW		
17-7-09	G	0.18	1	1	1	1	1	1	LOW		
17-7-10	A1	0.08	1	1	1	1	1	1	LOW		

ROAD NO.	SEG	MILE	Risk of	Risk to	Road	Stream	Floodplain	Flow	Aquatic	Remarks	
17-7-10	A2	0.12	1	1	1	1	1	1	LOW		
17-7-11	A	0.6	1	1	1	1	1	1	LOW		
17-7-13	B	0.13	1	1	1	1	1	1	LOW		
17-7-13	D	1.1	1	1	1	1	1	1	LOW		
17-7-13.01	B	0.12	1	1	1	1	1	1	LOW		
17-7-13.02		0.23	1	1	1	1	1	1	LOW		
17-7-13.03		0.15	1	1	1	1	1	1	LOW		
17-7-13.04		0.58	1	1	1	1	1	1	LOW		
17-7-13.05		0.2	1	1	1	1	1	1	LOW		
17-7-13.06		0.05	1	1	1	1	1	1	LOW		
17-7-15	A	0.5	1	1	1	1	1	1	LOW		
17-7-15.01	A	0.15	1	1	1	1	1	1	LOW		
17-7-21.01	A	0.34	1	1	1	1	1	1	LOW		
17-7-21.02	B	0.2	1	1	1	1	1	1	LOW		
17-7-21.02	D	0.44	1	1	1	1	1	1	LOW		
17-7-22	A1	0.35	1	1	1	1	1	1	LOW		
17-7-22	A2	0.55	1	1	1	1	1	1	LOW		
17-7-22	B	0.38	1	1	1	1	1	1	LOW		
17-7-22	C	0.37	1	1	1	1	1	1	LOW		
17-7-22	D	0.17	1	1	1	1	1	1	LOW		
17-7-22	E	1.23	1	1	1	1	1	1	LOW		
17-7-22	F	0.51	1	1	1	1	1	1	LOW		
17-7-22	G	1.29	1	1	1	1	1	1	LOW		
17-7-22	H	0.62	1	1	1	1	1	1	LOW		
17-7-22	I	0.48	1	1	1	1	1	1	LOW		
17-7-22	J	0.9	1	1	1	1	1	1	LOW		
17-7-22	K	0.9	1	1	1	1	1	1	LOW		
17-7-22.01	A	0.15	1	1	1	1	1	1	LOW		
17-7-22.01	B	0.14	1	1	1	1	1	1	LOW		
17-7-22.02	A3	0.3	1	1	1	1	1	1	LOW		
17-7-22.03	B	0.72	1	1	1	1	1	1	LOW		
17-7-22.04	B	1.2	1	1	1	1	1	1	LOW		
17-7-22.05	A	0.58	1	5	5	5	1	1	HIGH	culvert&sediment problem	
17-7-22.06		0.1	1	1	1	1	1	1	LOW		
17-7-27	A	0.34	1	1	1	1	1	1	LOW		
17-7-27	B	0.08	1	1	1	1	1	1	LOW		
17-7-27	C	0.02	1	1	1	1	1	1	LOW		
17-7-27	D	1.36	1	1	1	1	1	1	LOW		
17-7-34	B	0.66	1	1	1	1	1	1	LOW		
17-7-34.02	A	0.12	1	1	1	1	1	1	LOW		
17-7-34.02	B	0.09	1	1	1	1	1	1	LOW		
17-7-34.02	C	0.12	1	1	1	1	1	1	LOW		
17-7-34.02	D	0.02	1	1	1	1	1	1	LOW		
17-7-34.02	F	0.25	1	1	1	1	1	1	LOW		
17-7-35	A	0.77	1	1	1	1	1	1	LOW		
17-7-35.02		0.69	1	1	1	1	1	1	LOW		
17-7-35.03		0.22	1	1	1	1	1	1	LOW		
17-7-36	B	0.37	1	1	1	1	1	1	LOW		
18-6-03.01	A	0.15	1	1	1	1	1	1	LOW		
18-6-05	A	1.99	1	1	1	1	1	1	LOW		
18-6-05	B	1.5	1	1	1	1	1	1	LOW		
18-6-05	C	0.53	1	1	1	1	1	1	LOW		
18-6-05.03	A	0.26	1	1	1	1	1	1	LOW		
18-6-05.05	B	0.4	1	1	1	1	1	1	LOW		
18-6-05.05	C	0.1	1	1	1	1	1	1	LOW		
18-6-05.06		0.17	1	1	1	1	1	1	LOW		
18-6-08	B	0.05	1	1	1	1	1	1	LOW		
18-6-08	D	0.71	1	1	1	1	1	1	LOW		
18-6-08.05	B	1.02	1	1	1	1	1	1	LOW		
18-6-09.06	B	0.05	1	1	1	1	1	1	LOW		

ROAD NO.	SEG	MILE	Risk of	Risk to	Road	Stream	Floodplain	Flow	Aquatic	Remarks	
18-6-11		1.02	1	1	1	1	1	1	LOW		
18-6-11.01		0.11	1	1	1	1	1	1	LOW		
18-6-14		0.47	1	1	1	1	1	1	LOW		
18-6-17		1.01	1	1	1	1	1	1	LOW		
18-6-18.12	B	0.04	1	1	1	1	1	1	LOW		
18-6-21.04		0.32	1	1	1	1	1	1	LOW		
18-6-27.01		0.35	1	1	1	1	1	1	LOW		
18-6-27.02		0.54	1	1	1	1	1	1	LOW		
TOTALS:		110.2									

LONG TOM TRANSPORTATION PLAN - TERRESTRIAL RISK RATING

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL ISSUES (1-5)	RESERVES & SPECIAL MGT.AREAS (1-5)	SENSITIVE SPECIES (1-5)	TERRESTRIAL RISK RATING L/M/H	REMARKS
14-6-34	F	0.73	Y	1	1	1	L	
14-6-34	H	0.54	Y	1	1	2	L	
15-6-08.01		1.62	N	1	1	2	L	
15-6-09.02		0.76	N	1	1	1	L	
15-6-09.03	B	0.09	N	1	1	1	L	
15-6-09.04	A1	0.39	N	1	1	1	L	
15-6-09.04	A2	0.53	N	1	1	1	L	
15-6-09.05		0.44	N	1	1	1	L	
15-6-15	B	0.59	N	1	1	1	L	
15-6-15.02	B	0.08	Y	1	1	1	L	
15-6-21		0.36	Y	1	1	1	L	
15-6-21		1.42	N	1	1	1	L	
15-6-21.01	A	1.18	N	1	1	2	L	
15-6-21.01	B	0.28	N	1	1	2	L	
15-6-21.02		0.33	N	1	1	2	L	
15-6-21.03		0.36	N	1	1	1	L	
15-6-21.04		0.19	N	1	1	2	L	
15-6-21.05		0.15	N	1	1	2	L	
15-6-21.06		0.16	N	1	1	2	L	
15-6-21.07		0.15	N	1	1	1	L	
15-6-26	A	0.47	Y	1	1	2	L	
15-6-26	B	0.05	Y	1	1	2	L	
15-6-26	C	0.83	Y	1	1	2	L	
15-6-26	D	0.69	Y	1	1	2	L	
15-6-26	E	0.46	Y	1	1	2	L	
15-6-26	F	0.5	Y	1	1	2	L	
15-6-26	G	0.1	Y	1	1	2	L	
15-6-26	H	0.24	Y	1	1	2	L	
15-6-26.01		0.45	N	1	1	1	L	
15-6-26.02		1.49	N	1	1	1	L	
15-6-27		1.1	N	1	1	1	L	
15-6-27.01		0.65	N	1	1	1	L	
15-6-27.02		0.1	N	1	1	1	L	
15-6-27.03	A	0.09	N	1	1	1	L	
15-6-27.04		0.55	N	1	1	1	L	
15-6-27.05		0.54	N	1	1	1	L	
15-6-33	B	0.23	N	1	1	1	L	
15-6-33.01	A	0.4	Y	1	1	1	L	
15-6-33.01	B	0.37	Y	1	1	1	L	
15-6-33.01	C	0.36	Y	1	1	1	L	

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL	RESERVES	SENSITIVE	TERRESTRIAL	REMARKS
15-6-33.01	D	0.08	Y	1	1	1	L	
15-6-33.01	E	0.29	Y	1	1	1	L	
15-6-33.01	F	0.27	Y	1	1	1	L	
15-6-33.02	A	0.25	N	1	2	1	L	
15-6-33.03	A	0.1	N	1	2	1	L	
15-6-33.04	A	0.12	N	1	1	1	L	
15-6-33.05		0.9	N	1	1	1	L	
15-6-33.06		0.12	N	1	1	1	L	
16-5-07	B	0.26	N	1	2	3	M	
16-6-01		0.5	N	1	1	3	M	
16-6-02	A	0.26	Y	1	1	3	M	
16-6-02	B	0.59	N	1	1	3	M	
16-6-02.01	A2	0.29	N	1	1	3	M	
16-6-02.02	A2	0.9	N	1	1	1	L	
16-6-03.01		0.08	N	1	2	1	L	
16-6-03.02	A	0.22	N	1	2	1	L	
16-6-03.03	A	0.11	N	1	2	1	L	
16-6-03.04	A	0.48	N	1	2	1	L	
16-6-03.05	A	0.21	N	1	2	1	L	
16-6-05		0.26	N	1	2	1	L	
16-6-05.01		0.11	N	1	2	1	L	
16-6-05.02		0.1	N	1	2	1	L	
16-6-05.03	A	0.38	N	1	2	1	L	
16-6-05.04		0.19	N	1	2	1	L	
16-6-05.05		0.12	N	1	2	1	L	
16-6-05.06		0.24	N	1	2	1	L	
16-6-06	B	0.45	Y	1	2	1	L	
16-6-07.01	A	0.97	Y	1	2	1	L	
16-6-07.02	A	0.84	Y	1	2	1	L	
16-6-07.03	A	0.59	N	1	2	1	L	
16-6-08	B	0.15	N	1	2	1	L	
16-6-08	C	0.62	N	1	2	1	L	
16-6-08.02	A	0.14	Y	1	2	1	L	
16-6-09	A	2.08	N	1	2	1	L	
16-6-09.01		0.09	N	1	2	1	L	
16-6-09.02	A	0.08	N	1	2	1	L	
16-6-09.03	A	0.95	N	1	2	1	L	
16-6-09.04	A	0.18	N	1	2	1	L	
16-6-09.05	A	0.17	N	1	2	1	L	
16-6-09.06		0.18	N	1	2	1	L	
16-6-09.07		0.18	N	1	2	1	L	
16-6-09.08		0.24	N	1	2	1	L	
16-6-11.01	B	0.3	Y	1	1	1	L	
16-6-11.02		0.36	N	1	1	1	L	
16-6-11.03		0.38	N	1	1	1	L	
16-6-15	B	0.14	N	1	1	1	L	
16-6-17	A1	0.25	Y	1	2	1	L	
16-6-17	A2	0.51	Y	1	2	1	L	

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL	RESERVES	SENSITIVE	TERRESTRIAL	REMARKS
16-6-17	B	0.46	Y	1	2	1	L	
16-6-17	C	0.39	Y	1	2	1	L	
16-6-17	D	0.31	Y	1	2	1	L	
16-6-17	E	0.48	Y	1	2	1	L	
16-6-17	F	0.47	Y	1	2	1	L	
16-6-17	G	0.52	Y	1	2	1	L	
16-6-17	H	0.35	Y	1	2	1	L	
16-6-17.01	A	0.06	Y	1	2	1	L	
16-6-17.02		0.38	Y	1	2	1	L	
16-6-17.03	A	0.26	Y	1	2	1	L	
16-6-17.04		0.24	Y	1	2	1	L	
16-6-17.05		0.27	Y	1	2	1	L	
16-6-19		2.34	N	1	1	1	L	
16-6-19.01		0.54	N	1	1	1	L	
16-6-19.02	A	0.6	N	1	1	1	L	
16-6-19.03	A	0.1	N	1	1	1	L	
16-6-19.04	A	0.25	N	1	1	1	L	
16-6-20	A	0.08	Y	1	1	1	L	
16-6-20	B1	0.22	Y	1	1	1	L	
16-6-20	B2	0.48	Y	1	1	1	L	
16-6-20	C	0.08	Y	1	1	1	L	
16-6-20	D	0.49	Y	1	1	1	L	
16-6-20	E	0.08	Y	1	1	1	L	
16-6-20	F	0.61	Y	1	1	1	L	
16-6-20.01	B	0.16	N	1	2	1	L	
16-6-20.01	C	0.12	N	1	2	1	L	
16-6-20.01	D	0.11	N	1	2	1	L	
16-6-20.01	E	0.14	N	1	2	1	L	
16-6-26	B	0.12	N	1	1	1	L	
16-6-28	D	0.51	N	1	1	1	L	
16-6-31		3.07	Y	1	1	2	L	
16-6-33.01		0.38	N	1	2	1	L	
16-6-33.02		0.05	N	1	2	1	L	
16-6-33.03		0.18	Y	1	2	1	L	
16-6-33.04		0.08	Y	1	2	1	L	
16-7-01		0.82	Y	1	2	1	L	
16-7-01.01	A	0.2	N	1	2	1	L	
16-7-01.02		0.1	N	1	2	1	L	
16-7-01.03	A	0.16	N	1	2	1	L	
16-7-12	A2	0.71	N	1	2	1	L	
16-7-12	B	0.58	Y	1	2	1	L	
16-7-12	C	0.55	Y	1	2	1	L	
16-7-12	D	0.28	Y	1	2	1	L	
16-7-12	E	1.14	Y	1	2	1	L	
16-7-13		1	Y	1	2	1	L	
16-7-13.01		0.4	N	1	2	1	L	
16-7-13.02		0.09	N	1	2	1	L	
16-7-13.03		0.37	N	1	2	1	L	

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL	RESERVES	SENSITIVE	TERRESTRIAL	REMARKS
16-7-13.04	A	0.05	N	1	2	1	L	
16-7-23	B	0.3	Y	1	1	2	L	
16-7-23	C	0.26	Y	1	1	2	L	
16-7-23	F	0.82	Y	1	1	1	L	
16-7-23.02		1	Y	1	1	1	L	
16-7-25	A	1.62	N	1	1	2	L	
16-7-25.01	A	0.3	N	1	1	2	L	
16-7-25.02	A	0.4	N	1	1	2	L	
16-7-25.03	A	0.7	N	1	1	1	L	
16-7-26		0.32	N	1	1	1	L	
16-7-34.01	C	0.33	N	1	1	1	L	
16-7-35.01	A	0.49	N	1	1	1	L	
16-7-35.02	A	0.28	N	1	1	1	L	
17-6-04	B	0.54	Y	2	2	5	H	
17-6-04	D	0.23	N	2	2	5	H	
17-6-18		2.02	N	1	2	1	L	
17-6-30	B	0.28	N	1	1	1	L	
17-6-30.01	A	0.27	Y	2	2	5	H	
17-6-30.01	B	0.38	Y	2	2	5	H	
17-6-30.01	C	0.47	N	2	2	5	H	
17-7-01	A	1.27	Y	1	1	1	L	
17-7-01	B	0.69	Y	1	1	1	L	
17-7-01	C	1.24	Y	1	1	2	L	
17-7-01.01	A	0.05	Y	1	1	1	L	
17-7-01.03	A	0.12	Y	1	2	1	L	
17-7-01.03	C	0.59	Y	1	2	1	L	
17-7-01.03	D	0.4	Y	1	2	1	L	
17-7-02	B	0.66	N	1	1	1	L	
17-7-02	C	0.95	N	1	1	1	L	
17-7-02	E	0.15	N	1	1	1	L	
17-7-02.01	B	1.12	N	1	1	2	L	
17-7-09	C	0.41	Y	1	2	1	L	
17-7-09	D	0.3	Y	1	2	1	L	
17-7-09	E	0.41	Y	1	2	1	L	
17-7-09	F	0.12	Y	1	2	1	L	
17-7-09	G	0.18	N	1	2	1	L	
17-7-10	A1	0.08	N	1	2	1	L	
17-7-10	A2	0.12	N	1	2	1	L	
17-7-11	A	0.6	N	1	2	1	L	
17-7-13	B	0.13	N	1	2	1	L	
17-7-13	D	1.1	N	1	2	1	L	
17-7-13.01	B	0.12	N	1	2	1	L	
17-7-13.02		0.23	N	1	2	1	L	
17-7-13.03		0.15	N	1	2	1	L	
17-7-13.04		0.58	N	1	2	1	L	
17-7-13.05		0.2	N	1	2	1	L	
17-7-13.06		0.05	N	1	2	1	L	
17-7-15	A	0.5	N	1	3	1	M	

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL	RESERVES	SENSITIVE	TERRESTRIAL	REMARKS
17-7-15.01	A	0.15	N	1	3	1	M	
17-7-21.01	A	0.34	Y	1	1	1	L	
17-7-21.02	B	0.2	Y	1	1	1	L	
17-7-21.02	D	0.44	Y	1	1	1	L	
17-7-22	A1	0.35	Y	1	2	1	L	
17-7-22	A2	0.55	Y	1	2	1	L	
17-7-22	B	0.38	Y	1	2	1	L	
17-7-22	C	0.37	Y	1	2	1	L	
17-7-22	D	0.17	Y	1	2	1	L	
17-7-22	E	1.23	Y	1	2	1	L	
17-7-22	F	0.51	Y	1	2	1	L	
17-7-22	G	1.29	Y	1	2	1	L	
17-7-22	H	0.62	Y	1	2	1	L	
17-7-22	I	0.48	Y	1	2	1	L	
17-7-22	J	0.9	Y	1	2	1	L	
17-7-22	K	0.9	Y	1	2	1	L	
17-7-22.01	A	0.15	Y	1	1	1	L	
17-7-22.01	B	0.14	N	1	1	1	L	
17-7-22.02	A3	0.3	N	1	2	1	L	
17-7-22.03	B	0.72	N	1	2	1	L	
17-7-22.04	B	1.2	N	1	1	1	L	
17-7-22.05	A	0.58	N	1	1	1	L	
17-7-22.06		0.1	N	1	2	1	L	
17-7-27	A	0.34	Y	1	1	1	L	
17-7-27	B	0.08	Y	1	1	1	L	
17-7-27	C	0.02	Y	1	1	1	L	
17-7-27	D	1.36	Y	1	1	1	L	
17-7-34	B	0.66	Y	1	1	1	L	
17-7-34.02	A	0.12	N	1	2	1	L	
17-7-34.02	B	0.09	Y	1	2	1	L	
17-7-34.02	C	0.12	Y	1	2	1	L	
17-7-34.02	D	0.02	Y	1	2	1	L	
17-7-34.02	F	0.25	N	1	2	1	L	
17-7-35	A	0.77	Y	1	3	1	M	
17-7-35.02		0.69	N	1	3	1	M	
17-7-35.03		0.22	N	1	1	1	L	
17-7-36	B	0.37	Y	1	1	1	L	
18-6-03.01	A	0.15	N	1	1	1	L	
18-6-05	A	1.99	Y	1	2	1	L	
18-6-05	B	1.5	Y	1	2	1	L	
18-6-05	C	0.53	Y	1	2	1	L	
18-6-05.03	A	0.26	Y	1	2	1	L	
18-6-05.05	B	0.4	N	1	2	1	L	
18-6-05.05	C	0.1	N	1	2	1	L	
18-6-05.06		0.17	Y	1	2	1	L	
18-6-08	B	0.05	Y	1	1	1	L	
18-6-08	D	0.71	Y	1	1	1	L	
18-6-08.05	B	1.02	N	1	1	1	L	

ROAD NO.	SEG	MILE	SHARED?	EXTERNAL	RESERVES	SENSITIVE	TERRESTRIAL	REMARKS
18-6-09.06	B	0.05	N	1	1	1	L	
18-6-11		1.02	Y	1	1	1	L	
18-6-11.01		0.11	N	1	1	1	L	
18-6-14		0.47	N	1	2	1	L	
18-6-17		1.01	N	1	1	1	L	
18-6-18.12	B	0.04	N	1	1	1	L	
18-6-21.04		0.32	N	1	2	1	L	
18-6-27.01		0.35	N	1	2	1	L	
18-6-27.02		0.54	N	1	2	1	L	
TOTALS:		110.2						

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LONG TOM TRANSPORTATION PLAN

RATING SUMMARY AND TRANSPORTATION MANAGEMENT OBJECTIVES

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION
14-6-34	F	0.73	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3		
14-6-34	H	0.54	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3		
15-6-08.01		1.62	NAT	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		AFTER "LITTLE AL"TS
15-6-09.02		0.76	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1	2005	
15-6-09.03	B	0.09	ASC	2	BR	N	MAT	L	L	L	YES	OPEN/ML2		
15-6-09.04	A1	0.39	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1	2004	
15-6-09.04	A2	0.53	NAT	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1	2004	
15-6-09.05		0.44	ASC	2	BR	N	MAT	L	L	L	YES	OPEN/ML2		
15-6-15	B	0.59	NAT	1	NO	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-15.02	B	0.08	NAT	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2		
15-6-21	A	0.36	ASC	3	BP	Y	MAT	L	L	H	NO	OPEN/ML2		CLOSE GATE
15-6-21	B	1.42	ASC	3	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2004	
15-6-21.01	A	1.18	ASC	3	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2006	
15-6-21.01	B	0.28	ASC	3	BP	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-21.02		0.33	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-21.03		0.36	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-21.04		0.19	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2004	
15-6-21.05		0.15	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-21.06		0.16	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		
15-6-21.07		0.15	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2004	
15-6-26	A	0.47	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		CULVERT PROBLEM
15-6-26	B	0.05	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	C	0.83	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	D	0.69	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	E	0.46	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	F	0.5	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	G	0.1	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		
15-6-26	H	0.24	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4		

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
15-6-26.01		0.45	ASC	2	BP	N	MAT	H	L	L	NO	CLOSE/ML1		CULVERT PROBLEM	
15-6-26.02		1.49	ASC	3	BP	N	MAT	H	L	M	NO	CLOSE/ML1	2004		
15-6-27		1.1	ASC	3	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
15-6-27.01		0.65	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
15-6-27.02		0.1	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
15-6-27.03	A	0.09	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
15-6-27.04		0.55	ASC	2	BP	N	MAT	L	L	M	NO	CLOSE/ML1	2004		
15-6-27.05		0.54	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2005		
15-6-33	B	0.23	NAT	1	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
15-6-33.01	A	0.4	ASC	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4			
15-6-33.01	B	0.37	ASC	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4			
15-6-33.01	C	0.36	ASC	4	BP	Y	MAT	L	L	H	YES	OPEN/ML4			
15-6-33.01	D	0.08	ASC	2	BP	Y	MAT	L	L	H	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
15-6-33.01	E	0.29	ASC	2	BP	Y	MAT	L	L	H	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
15-6-33.01	F	0.27	ASC	2	BP	Y	MAT	L	L	H	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
15-6-33.02	A	0.25	NAT	1	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
15-6-33.03	A	0.1	NAT	2	BP	N	LSR	L	L	H	YES	OPEN/ML2			
15-6-33.04	A	0.12	NAT	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
15-6-33.05		0.9	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2003	COORDINATE W/ INDUSTRY	
15-6-33.06		0.12	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1	2003		
16-5-07	B	0.26	NAT	1	NO	N	LSR	L	M	L	NO	CLOSE/ML1			
16-6-01		0.5	ASC	2	BP	N	MAT	L	M	H	NO	CLOSE/ML1	2003		
16-6-02	A	0.26	ASC	2	BP	Y	MAT	L	M	H	YES	OPEN/ML2		RESIDENTIAL ACCESS	
16-6-02	B	0.59	NAT	2	BP	N	MAT	L	M	M	NO	CLOSE/ML1	2003		
16-6-02.01	A2	0.29	NAT	1	NO	N	MAT	L	M	L	NO	CLOSE/ML1			
16-6-02.02	A2	0.9	ASC	2	BA	N	L&M	L	L	L	YES	OPEN/ML2			
16-6-03.01		0.08	ASC	2	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-03.02	A	0.22	ASC	2	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-03.03	A	0.11	ASC	2	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-03.04	A	0.48	ASC	2	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-03.05	A	0.21	ASC	2	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05		0.26	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05.01		0.11	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			

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ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
16-6-05.02		0.1	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05.03	A	0.38	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05.04		0.19	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05.05		0.12	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-05.06		0.24	ASC	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-06	B	0.45	ASC	2	BR	Y	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-07.01	A	0.97	ASC	3	BP	Y	LSR	L	L	H	YES	OPEN/ML2		CLOSE GATE	
16-6-07.02	A	0.84	ASC	2	BR	Y	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-07.03	A	0.59	NAT	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-08	B	0.15	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-08	C	0.62	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-08.02	A	0.14	ASC	2	BP	Y	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-09	A	2.08	ASC	3	BP	N	LSR	L	L	M	YES	OPEN/ML3		CULVERT PROBLEM	
16-6-09.01		0.09	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.02	A	0.08	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.03	A	0.95	ASC	3	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.04	A	0.18	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.05	A	0.17	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.06		0.18	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2003		
16-6-09.07		0.18	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-09.08		0.24	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-11.01	B	0.3	NAT	2	BA	Y	MAT	L	L	H	YES	OPEN/ML2			
16-6-11.02		0.36	NAT	2	BA	N	MAT	L	L	M	YES	OPEN/ML2			
16-6-11.03		0.38	NAT	2	BA	N	MAT	L	L	M	YES	OPEN/ML2			
16-6-15	B	0.14	NAT	1	NO	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-17	A1	0.25	BST	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	A2	0.51	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	B	0.46	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	C	0.39	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	D	0.31	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	E	0.48	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	F	0.47	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17	G	0.52	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
16-6-17	H	0.35	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-6-17.01	A	0.06	NAT	2	BR	Y	LSR	L	L	H	YES	OPEN/ML2			
16-6-17.02		0.38	ASC	3	BP	Y	LSR	L	L	H	YES	OPEN/ML2			
16-6-17.03	A	0.26	ASC	2	BP	Y	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-17.04		0.24	NAT	2	BP	Y	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-17.05		0.27	ASC	2	BP	Y	LSR	L	L	L	NO	CLOSE/ML1			
16-6-19		2.34	ASC	3	BP	N	MAT	L	L	H	YES	OPEN/ML3			
16-6-19.01		0.54	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-19.02	A	0.6	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-19.03	A	0.1	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-19.04	A	0.25	NAT	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-20	A	0.08	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-6-20	B1	0.22	BST	4	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-6-20	B2	0.48	ASC	4	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-6-20	C	0.08	ASC	4	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-6-20	D	0.49	ASC	2	BP	Y	MAT	L	L	H	YES	OPEN/ML3		CULVERT PROBLEM	
16-6-20	E	0.08	ASC	2	BP	Y	MAT	L	L	H	YES	OPEN/ML2			
16-6-20	F	0.61	ASC	2	BP	Y	MAT	L	L	H	YES	OPEN/ML2			
16-6-20.01	B	0.16	ASC	3	BA	N	LSR	L	L	M	YES	OPEN/ML2			
16-6-20.01	C	0.12	ASC	3	BA	N	LSR	L	L	M	NO	CLOSE/ML1		CLOSE @ 17.7 JCT.	
16-6-20.01	D	0.11	ASC	3	BA	N	LSR	L	L	M	NO	CLOSE/ML1			
16-6-20.01	E	0.14	ASC	3	BA	N	LSR	L	L	L	NO	CLOSE/ML1			
16-6-26	B	0.12	NAT	2	BA	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-28	D	0.51	NAT		BR	N	MAT	L	L	L	NO	CLOSE/ML1			
16-6-31		3.07	ASC	4	BP	Y	MAT	L	L	H		OPEN/ML4			
16-6-33.01		0.38	ASC	2	BA	N	L&M	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-33.02		0.05	ASC	2	BA	N	L&M	L	L	L	NO	CLOSE/ML1			
16-6-33.03		0.18	ASC	2	BA	Y	L&M	L	L	H	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-6-33.04		0.08	ASC	2	BA	Y	L&M	L	L	H	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-7-01		0.82	ASC	2	BP	Y	LSR	H	L	L	NO	CLOSE/ML1		CONCUR/IND.&CULVERT PROB.	
16-7-01.01	A	0.2	NAT	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1		COORDINATE W/ INDUSTRY	
16-7-01.02		0.1	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1		CULVERT PROBLEM	
16-7-01.03	A	0.16	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
16-7-12	A2	0.71	ASC	2	BP	N	LSR	L	L	M	NO	CLOSE/ML1	2004		
16-7-12	B	0.58	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-7-12	C	0.55	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-7-12	D	0.28	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-7-12	E	1.14	ASC	4	BP	Y	LSR	L	L	H	YES	OPEN/ML4			
16-7-13		1	ASC	3	BP	Y	LSR	L	L	H	YES	OPEN/ML3			
16-7-13.01		0.4	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2004		
16-7-13.02		0.09	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2004		
16-7-13.03		0.37	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2004		
16-7-13.04	A	0.05	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1	2004		
16-7-23	B	0.3	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-7-23	C	0.26	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-7-23	F	0.82	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
16-7-23.02		1	NAT	2	BP	Y	MAT	L	L	H	NO	CLOSE/ML1		CURRENTLY CLOSED	
16-7-25	A	1.62	ASC	3	BP	N	MAT	L	L	M	YES	OPEN/ML2		CULVERT PROBLEM	
16-7-25.01	A	0.3	NAT	1	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-7-25.02	A	0.4	ASC	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
16-7-25.03	A	0.7	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
16-7-26		0.32	NAT	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
16-7-34.01	C	0.33	NAT	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
16-7-35.01	A	0.49	ASC	2	BP	N	CON	L	L	L	NO	CLOSE/ML1			
16-7-35.02	A	0.28	ASC	2	BP	N	CON	L	L	L	NO	CLOSE/ML1			
17-6-04	B	0.54	ASC	2	BA	Y	L&M	L	H	H	YES	OPEN/ML2			
17-6-04	D	0.23	ASC	2	BA	N	L&M	L	H	H	YES	OPEN/ML2			
17-6-18		2.02	ASC	3	BP	N	MAT	L	L	L	YES	OPEN/ML2		CULVERT PROBLEM	
17-6-30	B	0.28	NAT	2	BA	N	MAT	L	L	L	NO	CLOSE/ML1		CURRENTLY CLOSED	
17-6-30.01	A	0.27	ASC	2	BP	Y	LSR	L	H	H	YES	OPEN/ML2			
17-6-30.01	B	0.38	ASC	2	BP	Y	LSR	L	H	L	YES	OPEN/ML2			
17-6-30.01	C	0.47	ASC	2	BP	N	LSR	L	H	L	NO	CLOSE/ML1			
17-7-01	A	1.27	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3		CLOSE GATE	
17-7-01	B	0.69	ASC	3	BP	Y	MAT	L	L	M	YES	OPEN/ML3			
17-7-01	C	1.24	ASC	3	BP	Y	MAT	L	L	M	YES	OPEN/ML3			
17-7-01.01	A	0.05	NAT	2	BP	Y	LSR	L	L	H	YES	OPEN/ML2			

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ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
17-7-01.03	A	0.12	NAT	2	BP	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-01.03	C	0.59	NAT	2	NO	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-01.03	D	0.4	NAT	2	NO	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-02	B	0.66	NAT	2	BP	N	CON	L	L	L	NO	CLOSE/ML1			
17-7-02	C	0.95	NAT	2	BP	N	CON	L	L	L	NO	CLOSE/ML1			
17-7-02	E	0.15	NAT	2	BP	N	CON	L	L	L	NO	CLOSE/ML1			
17-7-02.01	B	1.12	NAT	2	NO	N	MAT	L	L	L	NO	CLOSE/ML1			
17-7-09	C	0.41	ASC	3	BR	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-09	D	0.3	ASC	3	BR	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-09	E	0.41	ASC	3	BR	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-09	F	0.12	ASC	3	BR	Y	LSR	L	L	H	YES	OPEN/ML2			
17-7-09	G	0.18	ASC	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-10	A1	0.08	ASC	2	BR	N	LSR	L	L	M	NO	CLOSE/ML1	2005		
17-7-10	A2	0.12	NAT	2	BR	N	LSR	L	L	M	NO	CLOSE/ML1	2005		
17-7-11	A	0.6	NAT	1	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13	B	0.13	NAT	1	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13	D	1.1	NAT	1	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13.01	B	0.12	NAT	1	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13.02		0.23	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13.03		0.15	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13.04		0.58	ASC	3	BP	N	LSR	L	L	L	YES	OPEN/ML2			
17-7-13.05		0.2	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-13.06		0.05	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-15	A	0.5	NAT	2	BP	N	LSR	L	M	L	NO	CLOSE/ML1			
17-7-15.01	A	0.15	ASC	2	BP	N	LSR	L	M	L	NO	CLOSE/ML1			
17-7-21.01	A	0.34	NAT	2	BP	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-21.02	B	0.2	ASC	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-21.02	D	0.44	ASC	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-22	A1	0.35	BST	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	A2	0.55	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	B	0.38	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	C	0.37	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	D	0.17	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			

APPENDIX E

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
17-7-22	E	1.23	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	F	0.51	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	G	1.29	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	H	0.62	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	I	0.48	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	J	0.9	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22	K	0.9	ASC	4	BP	Y	L&M	L	L	H	YES	OPEN/ML4			
17-7-22.01	A	0.15	NAT	2	BP	Y	MAT	L	L	L	NO	CLOSE/ML1		CONCUR/IND.&CULVERT PROB.	
17-7-22.01	B	0.14	NAT	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1		CULVERT PROBLEM	
17-7-22.02	A3	0.3	NAT	1	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-22.03	B	0.72	NAT	2	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-22.04	B	1.2	NAT	2	BP	N	MAT	L	L	L	NO	CLOSE/ML1			
17-7-22.05	A	0.58	NAT	2	BP	N	MAT	H	L	L	NO	CLOSE/ML1		SUBSOIL	
17-7-22.06		0.1	ASC	2	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
17-7-27	A	0.34	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
17-7-27	B	0.08	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
17-7-27	C	0.02	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
17-7-27	D	1.36	ASC	3	BP	Y	MAT	L	L	H	YES	OPEN/ML3			
17-7-34	B	0.66	ASC	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-34.02	A	0.12	NAT	1	BR	N	MAT	L	L	L	NO	CLOSE/ML1		CURRENTLY CLOSED	
17-7-34.02	B	0.09	ASC	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-34.02	C	0.12	ASC	2	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-34.02	D	0.02	NAT	1	BR	Y	MAT	L	L	H	YES	OPEN/ML2			
17-7-34.02	F	0.25	NAT	2	BR	N	MAT	L	L	L	YES	OPEN/ML2			
17-7-35	A	0.77	NAT	2	BR	Y	MAT	L	M	H	YES	OPEN/ML2			
17-7-35.02		0.69	NAT	2	BR	N	MAT	L	M	M	YES	OPEN/ML2			
17-7-35.03		0.22	NAT	2	BR	N	MAT	L	L	M	YES	OPEN/ML2			
17-7-36	B	0.37	NAT	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-03.01	A	0.15	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-05	A	1.99	ASC	3	BR	Y	L&M	L	L	H	YES	OPEN/ML3		INSTALL GATE	
18-6-05	B	1.5	ASC	3	BR	Y	L&M	L	L	H	YES	OPEN/ML3			
18-6-05	C	0.53	ASC	3	BR	Y	L&M	L	L	H	YES	OPEN/ML3			
18-6-05.03	A	0.26	ASC	2	BR	Y	LSR	L	L	H	YES	OPEN/ML2			

ROAD NO.	SEG	MILE	SURF	ML	RTS	JT?	LUA	AQUA	TERRE.	HUMAN	NEED FOR FIRE?	TMO	YEAR CLOSE	CORRECTIVE ACTION	
18-6-05.05	B	0.4	NAT	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
18-6-05.05	C	0.1	NAT	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
18-6-05.06		0.17	NAT	2	BR	Y	LSR	L	L	L	YES	OPEN/ML2			
18-6-08	B	0.05	ASC	3	BR	Y	MAT	L	L	H	YES	OPEN/ML3			
18-6-08	D	0.71	ASC	3	BR	Y	MAT	L	L	H	YES	OPEN/ML3			
18-6-08.05	B	1.02	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-09.06	B	0.05	NAT	1	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-11		1.02	ASC	2	BP	Y	MAT	L	L	H	YES	OPEN/ML2			
18-6-11.01		0.11	ASC	2	BP	N	MAT	L	L	M	YES	OPEN/ML2			
18-6-14		0.47	NAT	1	NO	N	LSR	L	L	L	NO	CLOSE/ML1			
18-6-17		1.01	ASC	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-18.12	B	0.04	NAT	2	BR	N	MAT	L	L	L	NO	CLOSE/ML1			
18-6-21.04		0.32	NAT	1	BP	N	LSR	L	L	L	NO	CLOSE/ML1			
18-6-27.01		0.35	ASC	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
18-6-27.02		0.54	ASC	2	BR	N	LSR	L	L	L	NO	CLOSE/ML1			
TOTALS:		110.2													

APPENDIX E

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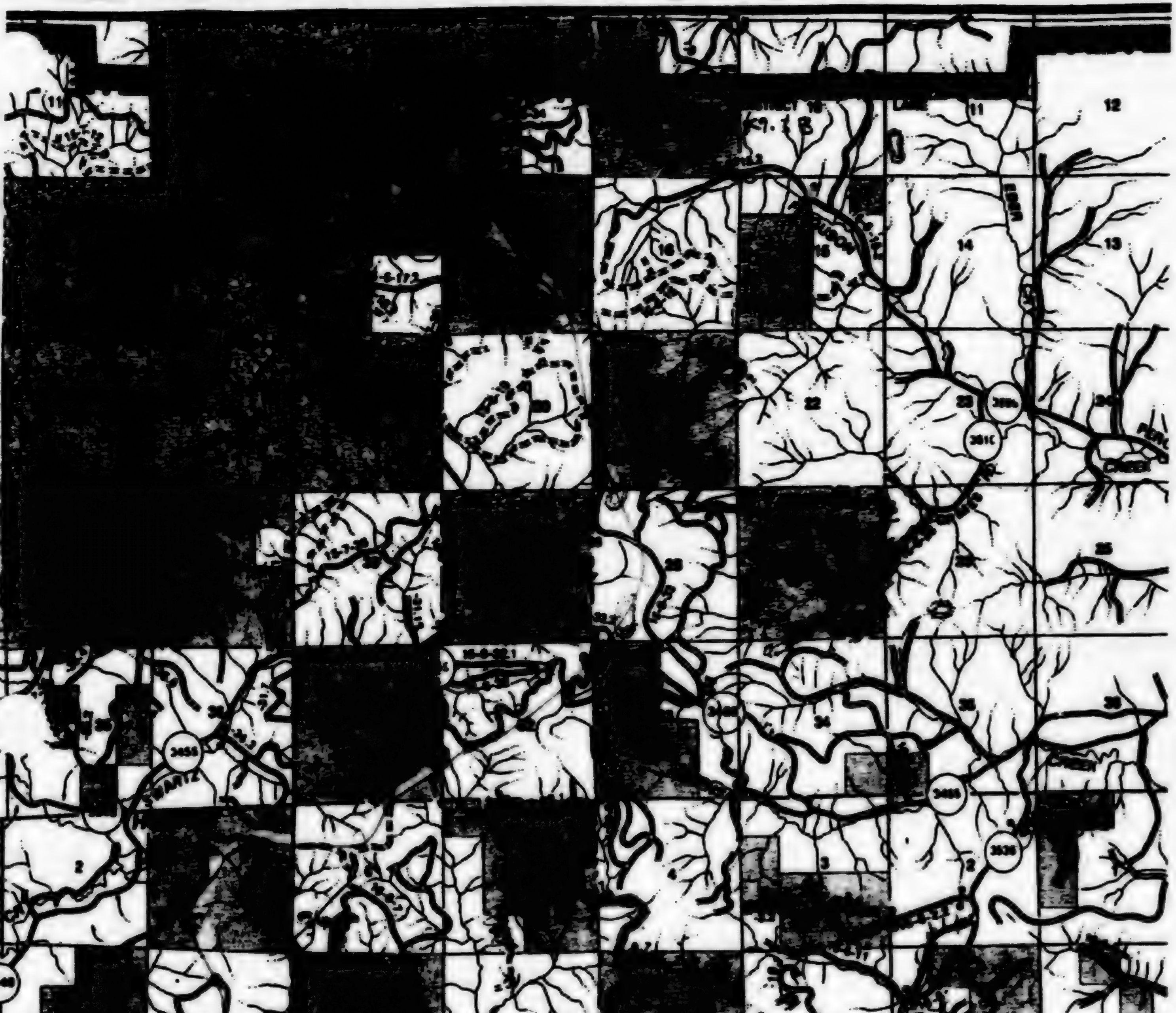
▬ BLM CONTROLLED ROADS

▬ BLM CONTROLLED ROADS TO BE CLOSED

1 of 4



APPENDIX F

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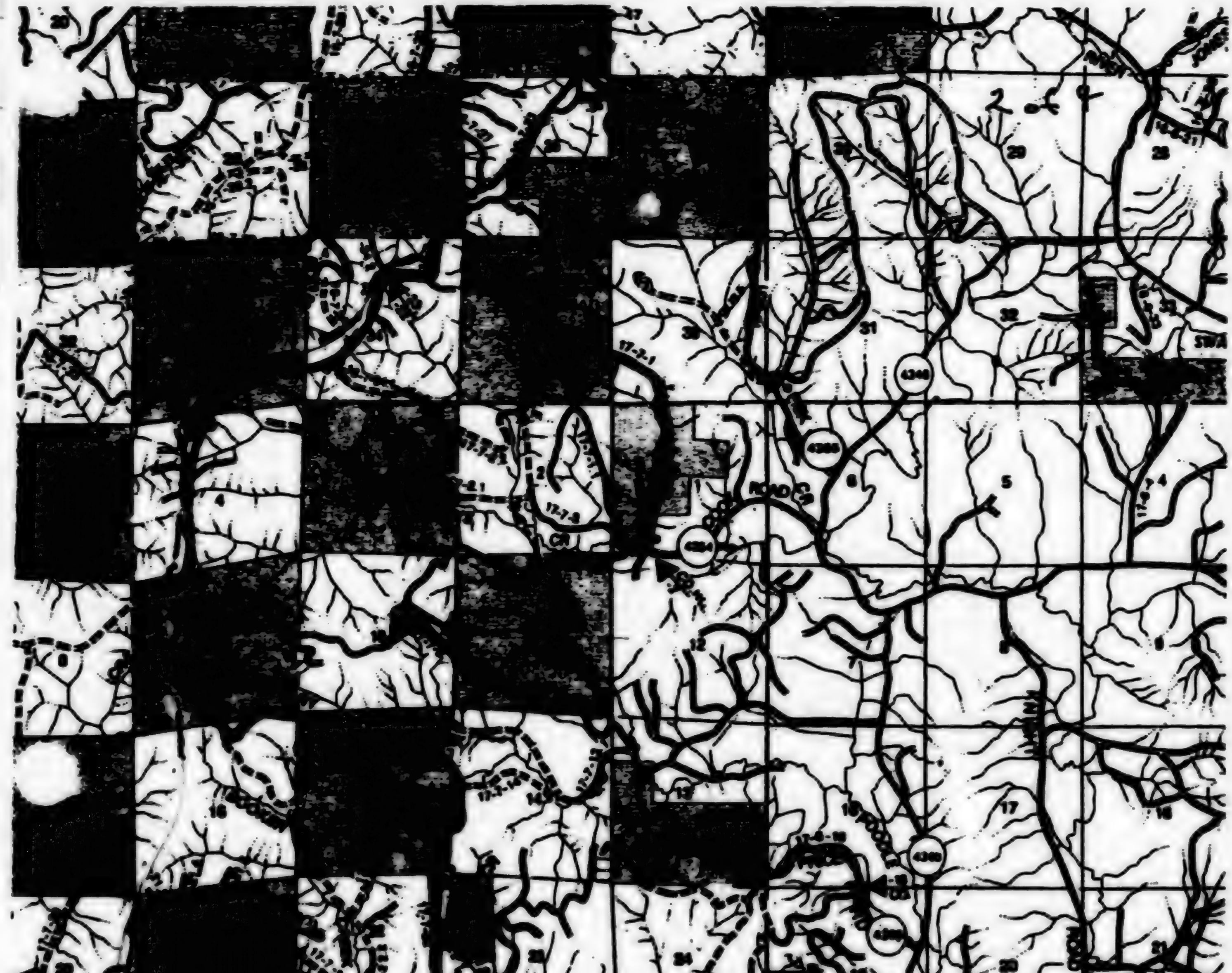
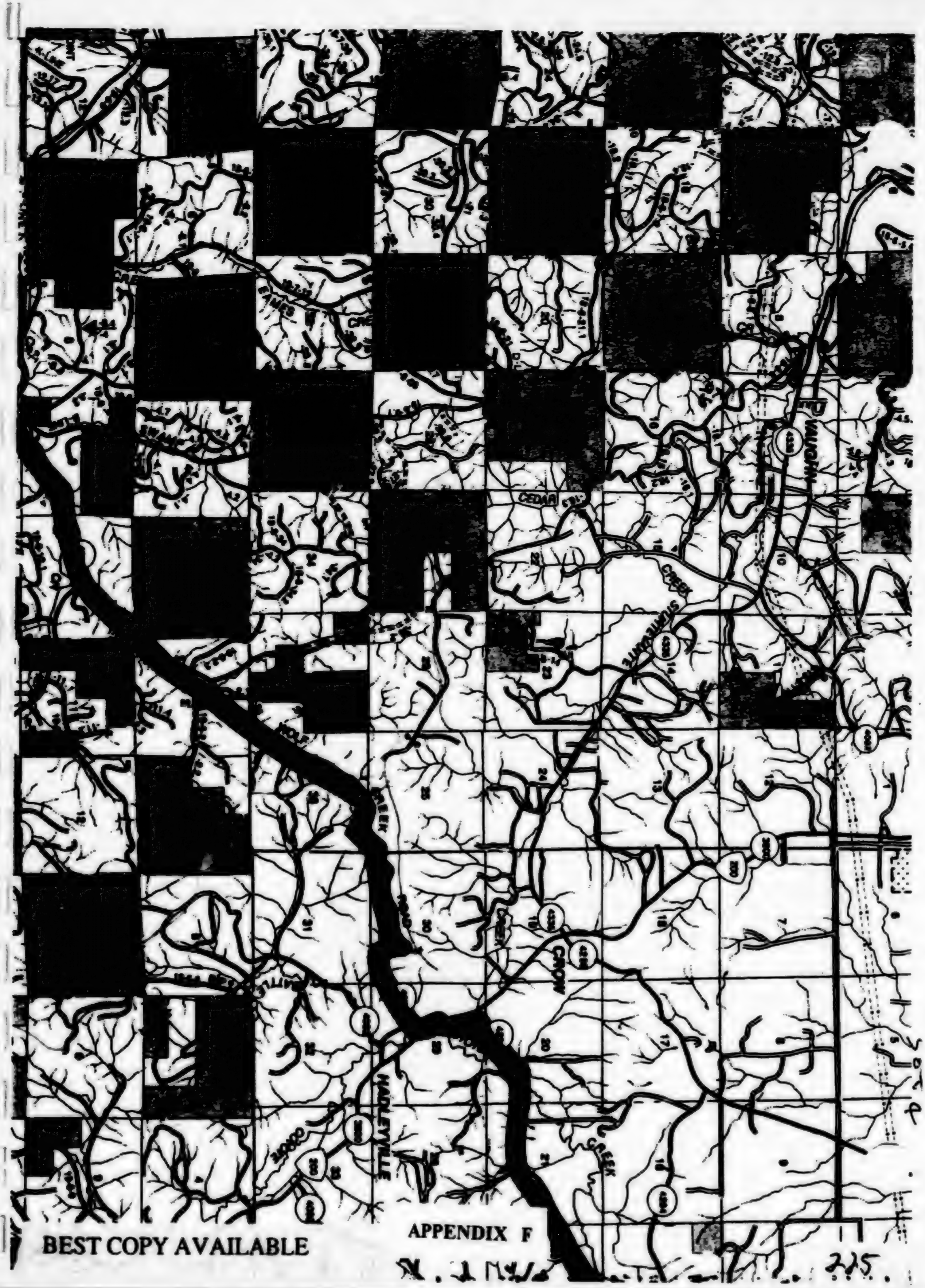


APPENDIX F



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APPENDIX F

ROAD #		SURF TYPE	MILES	ACCESS	LUA	SHARED	TRANS MGMT OBJECTIVE	ROAD NAME
18-5-14	B	ASC	1.01	BR	M	N	Open--ML3	ERICKSON ROAD
18-5-31	A	ASC	0.49	BP	M	Y	Open--ML5	BATTLE CREEK ROAD
18-5-31	B	NAT	0.50	BP	M	N	Open--ML1	
19-4-03	ALL	NAT	0.40	BR	M	N	Open--ML1	
19-4-03	S	NAT	0.26	BR	M	N	Open--ML1	SPUR WEST
19-4-04	A	ASC	0.41	BP	M	Y	Open--ML4	PERRY ROAD
19-4-04	B	ASC	2.03	BP	M	Y	Open--ML4	PERRY ROAD
19-4-04	C	NAT	0.20	BP	M	N	Closed--Decom'd '94	PERRY ROAD
19-4-04.01	B	NAT	0.09	BR	M	N	Open--ML1	
19-4-09	B	NAT	0.14	BP	M	N	Open--ML1 Decom'd '94	
19-4-09.01	ALL	NAT	0.40	BP	M	N	Closed--Decom'd '94	
19-4-09.02	ALL	ASC	0.13	BP	M	N	Open--ML3	
19-4-17	ALL	ASC	0.14	BP	M	N	Closed--Decom'd '94	
19-4-17.01	ALL	NAT	0.33	BR	M	N	Closed--Decom'd '94	QUILL HILL
19-4-20	ALL	ASC	0.27	BR	M	N	Open--ML3	
19-4-21	A	ASC	0.02	BP	M	Y	Open--ML4	
19-4-21	C	ASC	0.36	BR	M	Y	Open--ML4	
19-4-21	E	ASC	0.30	BP	M	Y	Open--ML3	
19-4-21.01	A	ASC	0.03	BP	M	Y	Open--ML2	THURSTON ROAD
19-4-21.01	C	NAT	0.48	BR	M	N	Open--ML1	THURSTON ROAD
19-4-21.02	B	NAT	0.21	BR	M	Y	Open--ML2	
19-4-21.02	D	NAT	0.17	BR	M	N	Open--ML1	
19-4-21.03	ALL	NAT	0.33	BP	M	N	Closed--Decom'd '93	
19-4-22.01	ALL	ASC	0.48	BR	M	Y	Open--ML4	
19-4-22.02	ALL	ASC	0.31	BR	M	N	Open--ML4	
19-4-29	A	ASC	0.49	BP	M	Y	Open--ML4	P.O. PLENTY
19-4-29	B	ASC	0.51	BR	M	Y	Open--ML4	P.O. PLENTY
19-4-29	C	ASC	0.24	BR	M	N	Open--ML4	P.O. PLENTY
19-4-29	D	ASC	0.26	BR	M	N	Open--ML4	P.O. PLENTY
19-4-29.02	ALL	NAT	0.18	BP	M	N	Open--ML1	

LONG TOM WATERSHED TRANSPORTATION MANAGEMENT PLAN, SOUTH VALLEY RESOURCE AREA

ROAD #		SURF TYPE	MILES	ACCESS	LUA	SHARED	TRANS MGMT OBJECTIVE	ROAD NAME
19-4-29.03	ALL	ASC	0.21	BP	M	N	Open--ML3	
19-5-05	ALL	ASC	3.15	BP	M	Y	Open--ML5	BATTLE CREEK ROAD
19-5-05.01	ALL	ASC	0.05	BP	M	Y	Open--ML3	
19-5-05.02	ALL	ASC	0.23	BP	M	N	Open--ML3	
19-5-05.03	ALL	ASC	0.07	BP	M	N	Open--ML3	
19-5-05.04	ALL	ASC	0.24	BP	M	N	Open--ML3	
19-5-05.05	ALL	ASC	0.25	BP	M	N	Open--ML3	
19-5-05.06	ALL	ASC	0.09	BP	M	N	Open--ML3	
19-5-06.01	B	NAT	0.02	BR	M	Y	Open--ML2	
19-5-07.04	A2	NAT	0.42	BP	M	Y	Open--ML1	
19-5-09	B	NAT	0.27	BR	M	N	Open--ML1	
19-5-15	ALL	NAT	0.60	BR	M	N	Open--ML1	
19-5-16.04	ALL	ASC	0.58	BP	M	N	Open--ML4	HELTER SPUR
19-5-16.05	ALL	ASC	0.33	BP	M	N	Open--ML4	
19-5-17.02	ALL	ASC	1.17	BP	M	N	Open--ML4	
19-5-18	C	ASC	1.31	BP	MMR	Y	Open--ML4	WOLF POINT
19-5-18	D	ASC	0.26	BP	MMR	Y	Open--ML4	
19-5-21	A	ASC	0.37	BP	M	N	Open--ML3	
19-5-21	B	NAT	0.42	BP	M	N	Open--ML1	
19-5-21.01	ALL	ASC	0.42	BP	M	N	Open--ML3	
19-5-21.03	ALL	ASC	1.07	BP	M	N	Open--ML4	
19-5-21.04	ALL	ASC	0.43	BP	M	N	Open--ML4	
19-5-21.05	ALL	ASC	0.58	BP	M	N	Open--ML4	
19-5-21.06	ALL	ASC	0.03	BP	M	N	Open--ML3	
19-5-21.07	ALL	ASC	0.13	BP	M	N	Open--ML3	
19-5-21.08	ALL	ASC	0.28	BP	M	N	Open--ML3	WILTING ROAD
19-5-21.09	ALL	ASC	1.33	BP	M	N	Open--ML4	HELTER SKELTER
19-5-21.10	ALL	ASC	0.28	BP	M	N	Open--ML2	
19-5-22	B	NAT	0.15	BP	M	N	Open--ML1	

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ROAD #		SURF TYPE	MILES	ACCESS	LUA	SHARED	TRANS MGMT OBJECTIVE	ROAD NAME
19-5-22.01	ALL	ASC	0.50	BP	M	Y	Open--ML4	MCCULLOCH ROAD
19-5-22.02	A	BST	0.90	BP	M	Y	Open--ML5	SCHAFFER ROAD
19-5-22.02	B	ASC	0.84	BP	M	Y	Open--ML5	SCHAFFER ROAD
19-5-22.02	C	ASC	1.88	BP	M	Y	Open--ML5	SCHAFFER ROAD
19-5-27	B	NAT	0.22	BR	M	N	Open--ML1	
19-5-27.01	A	ASC	0.24	BP	M	Y	Open--ML3	
19-5-27.02	ALL	ASC	0.28	BP	M	N	Open--ML3	
19-5-27.03	ALL	ASC	0.07	BP	M	N	Open--ML3	
19-5-27.04	ALL	NAT	0.08	BR	M	N	Open--ML1	
19-5-27.05	ALL	NAT	0.62	BR	M	N	Closed--Decom'd '94	
19-5-27.06	ALL	ASC	0.12	BP	M	N	Open--ML3	
19-5-28	B	NAT	0.05	BR	M	N	Open--ML1	HULL EASEMENT
19-5-29.01	ALL	ASC	0.40	BP	MMR	N	Open--ML3	
19-5-29.02	ALL	ASC	0.64	BP	MMR	N	Open--ML3	
19-6-01.02	A	ASC	0.20	BR	MMR	N	Open--ML4	
19-6-01.02	B	ASC	0.15	BR	MMR	Y	Open--ML3	
19-6-01.02	C	ASC	0.08	BR	MMR	N	Open--ML2	
19-6-01.03	ALL	ASC	0.50	BR	MMR	N	Open--ML4	
20-4-05	B	NAT	0.25	BR	M	N	Open--ML1	
20-4-07.01	C	ASC	1.18	BP	[illegible]	N	Open--ML5	

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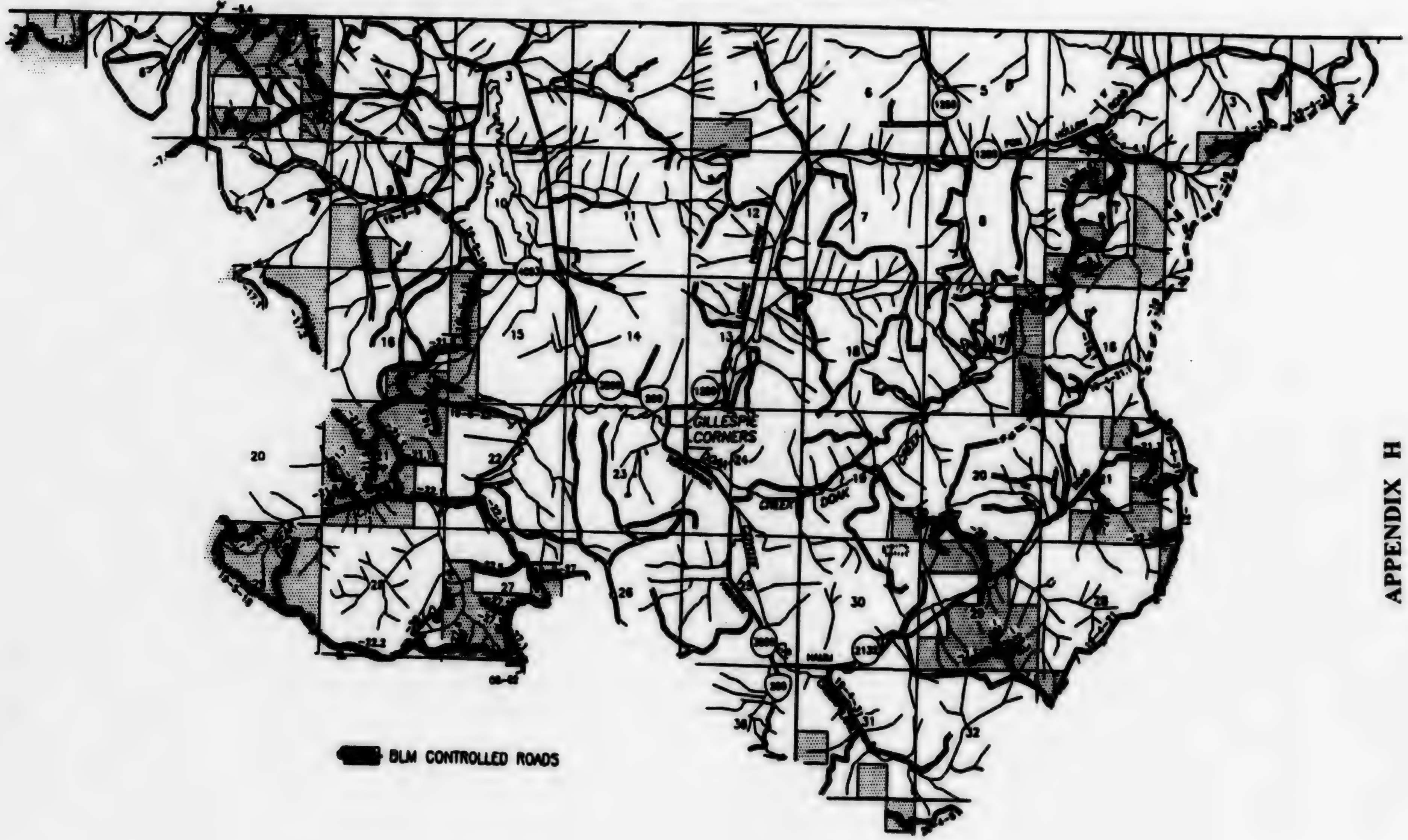
LONG TOM WATERSHED, SOUTH VALLEY RESOURCE AREA



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APPENDIX E
Climate

Long-Term Wet-Dry Cycles in Oregon

George H. Taylor
March 1999

Reliable weather and climate information for Oregon extend back about 100 years. During that time, there have been about an equal number of wet years and dry years. We find, however, that during some periods there is a preponderance of wetter than average years while in others there are mostly dry years. These wet and dry "cycles" generally span 20-25 years. The dry years tend to be warm (due to reduced cloudiness, most likely) and the wet years cool.

Figure 1 shows Water Year precipitation (Oct-Sept) for the Oregon Coast Division (Zone 1) since 1896. Notice the dry (and warm) periods from about 1920-1945 and 1975-1994, and the wet periods before and after. The last four years have been quite wet. **Figure 2** shows Portland precipitation since 1920. The wet/dry periods are similar, coinciding almost exactly with those on the coast. Are the recent wet years a harbinger of things to come? Have we reentered a wet cycle?

The Global "Conveyor Belt"

Several years ago I heard a talk by Dr. William Gray (see Omy and Landsea, 1993) that described an exciting new finding based on the work of an oceanographer, Wallace Broeker. Broeker (1991) suggested that there is a global-scale current, operating on a time scale of several decades, which affects worldwide weather patterns. Broeker used data from ice cores to postulate that changes in this current may have been a primary triggering mechanism for the last ice age. Gray and Landsea, however, were more interested in our era. Gray has received acclaim for his work in predicting Atlantic hurricanes, with significant success.

The "conveyor belt" involves transport of warm ocean water from the Pacific through the Indian Ocean and into the Atlantic. In the north Atlantic, this warm water (now very saline due to evaporation during the journey), encounters cold water coming down from the north. The warm water cools quickly, and sinks (due to greater density). This sets up a sub-surface countercurrent which transports the cool water back to the Indian and Pacific oceans. **Figure 3** illustrates the warm and cold currents associated with an active conveyor cycle.

In looking back over the last 100 years, Gray and Landsea identified four distinct periods, two when the conveyor belt was very active, two when it was quite inactive. They also found several important atmospheric phenomena which correlate quite well with the strength of the conveyor; we have added precipitation in the Northwest to the table (**Figure 4**). Note also that global temperatures seem to correspond to the active-inactive phases as well. This should not surprise us, since the tropical Pacific is the largest terrestrial heat source to the atmosphere; when the

Pacific warms, so does the atmosphere. And during El Nino events, the Pacific temperatures (taken overall) warm significantly. Thus the warmup during El Nino-dominated inactive periods. Gray and Landsca suggest that we may be entering a period of strong conveyor belt activity again. Consider how the four major indicators have changed over the last several years:

1. Atlantic Hurricanes. After the quietest 4-year period of the last 50 years during 1991-94, 1995 had the largest number of hurricanes since storms were first named in the early 1950s. 1996 and 1998 were active years, and 1997 was about average. The latest four-year period is the busiest on record.

2. Sahel precipitation. The last four years have seen near-average precipitation after many years of severe drought.

3. El Nino. Following a 20-year period with only one La Nina, three of the last four years have seen La Nina conditions in the Pacific.

4. Precipitation in the Northwest. Following the very dry 1975-94 period, which saw two significant statewide droughts and 10 consecutive dry years, we are now completing the fifth consecutive above-average year.

Predictions

The signs are there. All indications are that the Conveyor Belt has switched back to "active" again, portending a mostly wet regime for the next 20 years or so. If history repeats itself, we can expect:

- frequent floods
- no droughts
- about 75% of all years wetter than average
- relatively cool

Note that the above predictions apply to the cool season only. Summers do not necessarily reflect those trends. Our usual warm, dry, beautiful Northwest summers will still be here.

Technical note: Atlantic Hurricanes and Portland Precipitation

Since the number of Atlantic hurricanes seems to correspond to precipitation in the Northwest, we decided to plot both types of data together to see how well they correlate. As can be seen in **Figure 5**, there is a very strong correlation indeed. Active hurricane years are almost always followed by wetter than average winter conditions in Portland, and inactive years by dry winters. This graph not only validates the Conveyor Belt concept, it suggests that hurricane frequency can be used effectively to predict Portland precipitation the following winter.

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MONTHLY MEANS AND EXTREMES
Fern Ridge Dam, Oregon

Period: 1961-1990

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Temperature (F)													
Maximum	46.2	51.3	55.3	59.3	66.2	73.3	80.3	80.9	75.3	64.5	52.6	46.4	62.6
Minimum	32.6	35.0	36.5	38.6	43.1	48.7	51.7	52.3	48.7	43.0	38.0	34.1	41.8
Mean	39.4	43.1	45.9	49.0	54.6	61.0	66.0	66.6	62.0	53.7	45.2	40.3	52.2
Extreme Temperature (F)													
Maximum	65	69	77	83	95	97	103	107	102	92	73	66	107
Minimum	9	6	4	25	31	35	39	40	32	25	16	-3	-3
Precipitation (inches)													
Monthly mean	6.41	5.02	4.50	2.67	1.85	1.19	.39	.74	1.31	2.84	7.03	8.08	42.11
Extreme 24-hour	3.12	3.66	1.63	1.40	1.82	1.30	1.17	1.42	1.26	2.58	2.90	3.40	3.66
Snowfall (inches)													
Monthly mean	1.53	.49	.08	.00	.00	.00	.00	.00	.00	.00	.10	.99	3.36
Average number of days													
TEMPERATURE													
Maximum 90 or more	.0	.0	.0	.0	.1	1.2	4.7	4.7	1.7	.1	.0	.0	12.3
Maximum 32 or less	1.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	1.0	2.6
Minimum 32 or less	15.5	10.6	7.5	7.5	.3	.0	.0	.0	.0	.9	6.9	12.0	57.5
Minimum 0 or less	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.2
PRECIPITATION													
.01 inches or more	19.3	17.3	19.1	19.1	11.9	7.5	3.2	4.2	7.2	12.8	20.1	21.4	161.6
.10 inches or more	12.7	10.9	11.3	11.3	5.8	3.4	1.2	1.7	3.9	6.9	13.0	13.9	93.0
.50 inches or more	4.4	3.2	2.8	2.8	.8	.5	.1	.4	.6	1.7	5.2	5.7	26.5
1.00 inches or more	1.4	.8	.5	.5	.1	.1	.0	.1	.1	.3	1.6	2.0	7.1
Degree Days													
Heating days @ 65°F	794	618	592	481	327	151	54	41	120	350	594	765	4901
Growing days @ 50°F	4	5	17	53	263	330	496	514	360	141	17	4	2095

MONTHLY MEANS AND EXTREMES
Eugene, Oregon

Period: 1961-1990

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Temperature (F)													
Maximum	46.3	51.3	55.9	60.5	67.1	74.4	82.0	82.0	76.2	64.6	52.5	46.2	623.3
Minimum	33.5	35.4	37.2	39.0	42.9	48.3	51.4	51.9	47.8	42.0	38.2	34.3	41.8
Mean	39.9	43.4	46.6	49.7	55.0	61.4	66.7	66.9	62.0	53.3	45.3	40.2	52.5
Extreme Temperature (F)													
Maximum	67	71	77	83	93	100	105	108	103	94	76	68	108
Minimum	1	4	21	27	29	32	39	38	32	19	12	-12	-12
Precipitation (inches)													
Monthly mean	7.91	5.64	5.51	3.11	2.16	1.43	.51	1.08	1.67	3.41	8.32	8.61	49.36
Extreme 24-hour	4.74	3.87	2.21	2.05	1.94	1.34	2.41	1.88	1.34	2.91	3.20	4.89	4.89
Snowfall (inches)													
Monthly mean	3.09	.49	.23	.00	.00	.00	.00	.00	.00	.00	.23	1.69	6.13
Average number of days													
TEMPERATURE													
Maximum 90 or more	.0	.0	.0	.0	.2	1.3	6.3	5.8	2.2	.1	.0	.0	16.0
Maximum 32 or less	1.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	1.2	3.1
Minimum 32 or less	13.6	10.6	6.3	2.7	.4	.0	.0	.0	.1	2.0	6.6	11.5	52.4
Minimum 0 or less	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.2
PRECIPITATION													
.01 inches or more	16.8	17.3	16.1	12.4	9.7	6.3	2.7	4.0	6.1	10.4	17.1	17.6	133.9
.10 inches or more	11.8	10.9	11.4	7.7	5.7	3.8	1.3	2.4	3.8	7.1	12.9	12.7	91.2
.50 inches or more	5.3	3.2	3.8	1.8	1.1	.8	.2	.7	1.1	2.3	6.4	5.8	33.1
1.00 inches or more	2.4	.8	1.2	.5	.2	.1	.0	.2	.3	.5	2.6	2.4	11.7
Degree Days													
Heating days @ 65°F	778	618	571	458	316	138	41	32	118	364	590	768	4784
Growing days @ 50°F	7	5	21	58	167	340	517	525	361	131	24	6	2166

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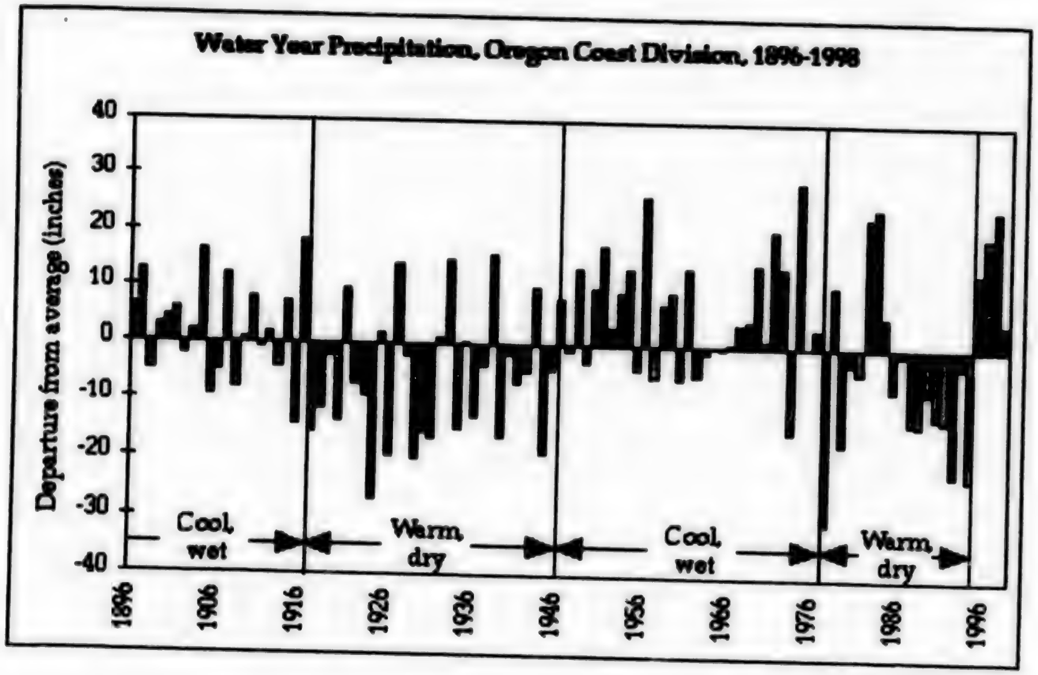

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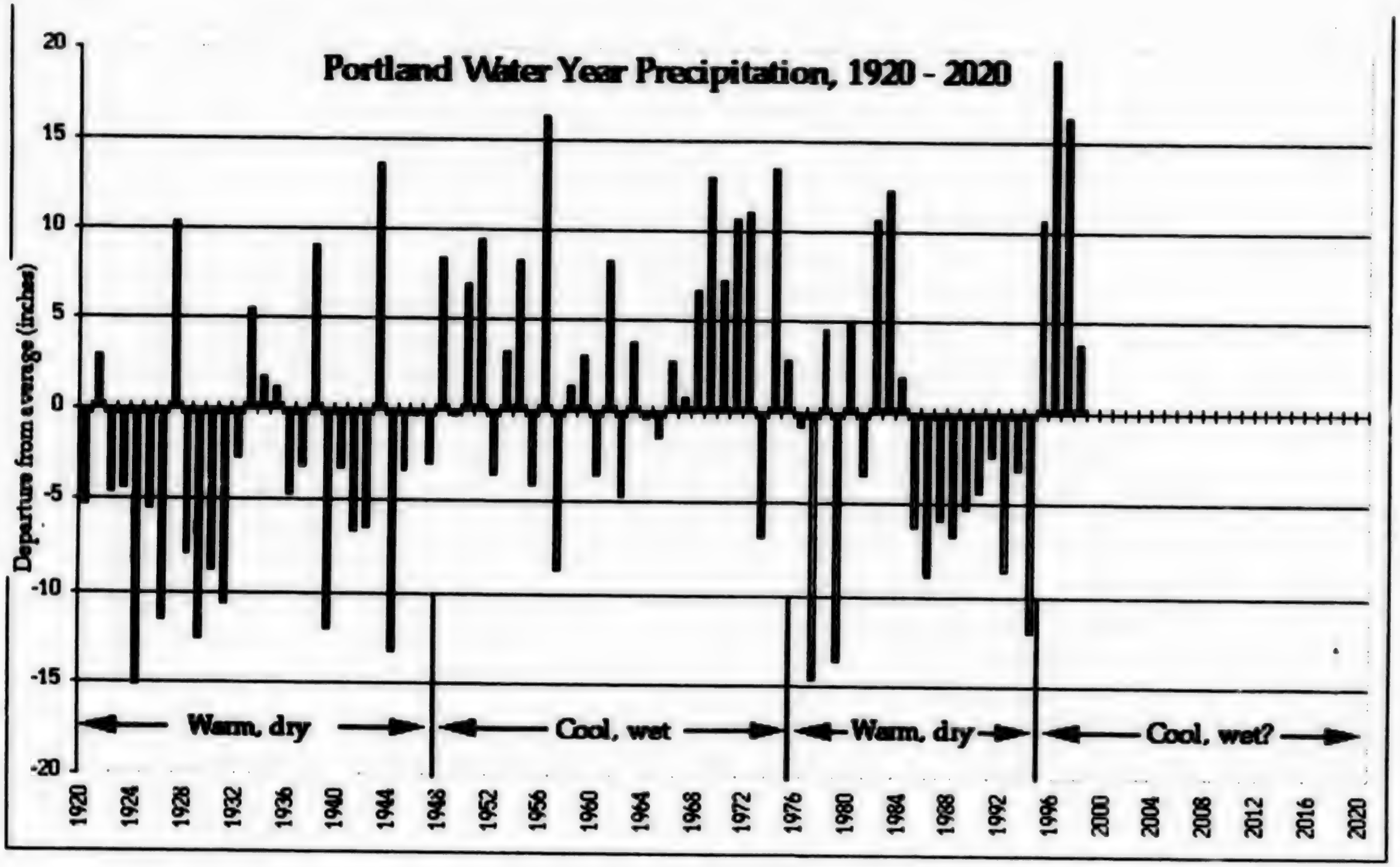
Portland Water Year Precipitation, 1920 - 2020

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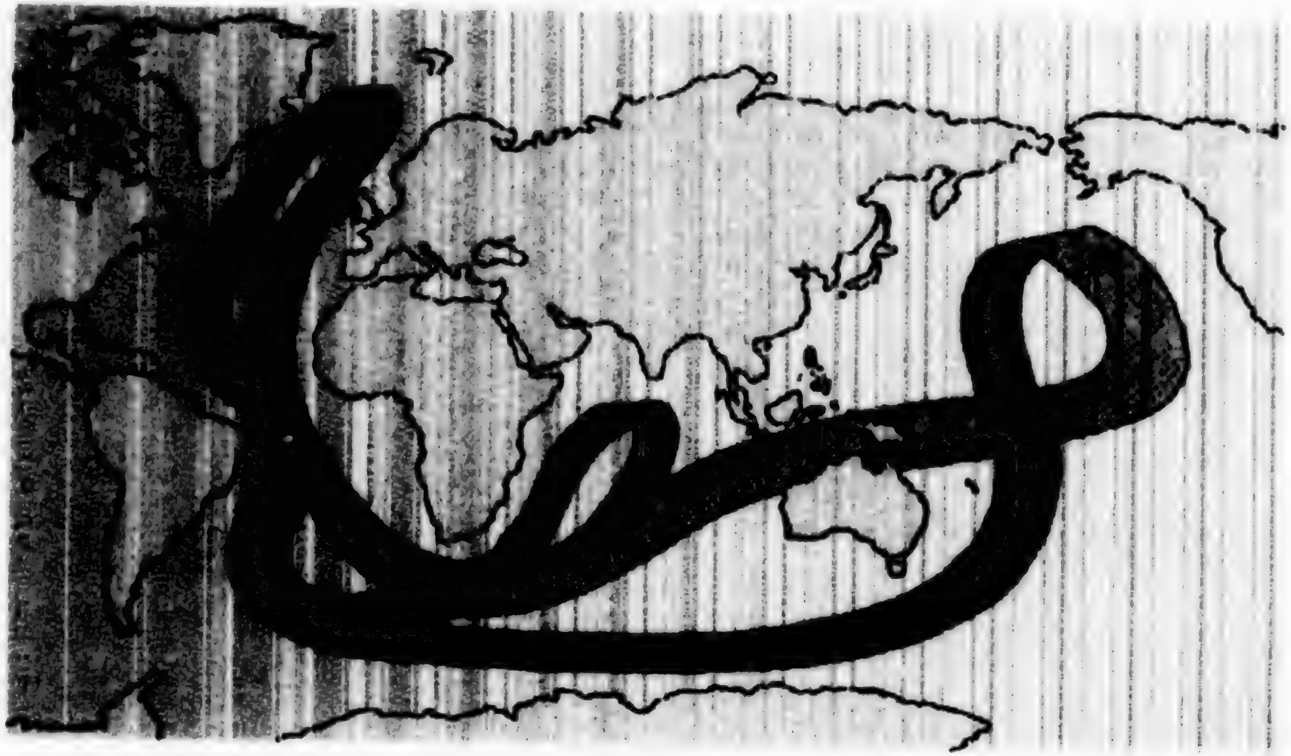
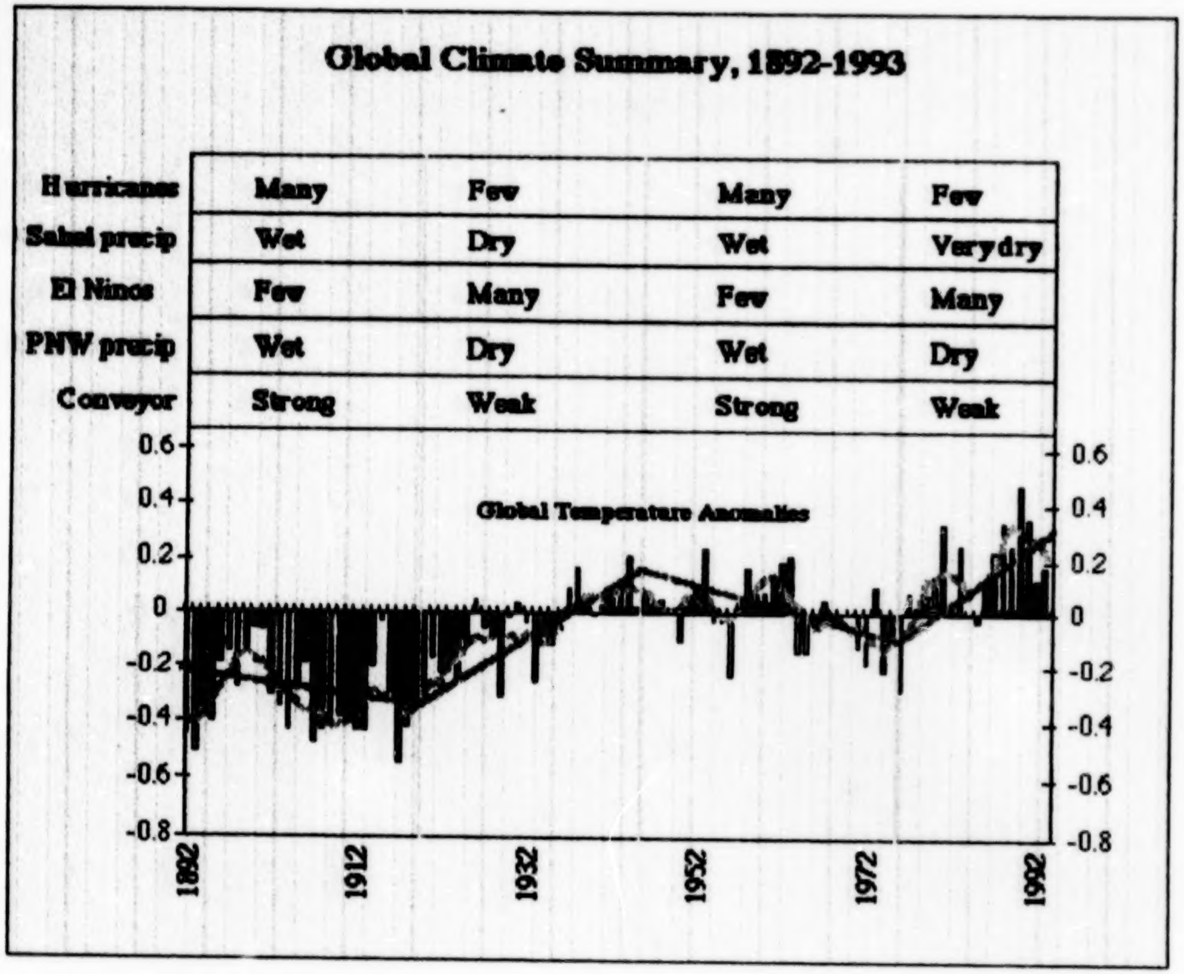
The Oceanic "Conveyor Belt"



Oregon Climate Service



Global Climate Summary, 1892-1993

Hurricanes	Many	Few	Many	Few
Sahel precip	Wet	Dry	Wet	Verydry
El Ninos	Few	Many	Few	Many
PNW precip	Wet	Dry	Wet	Dry
Conveyor	Strong	Weak	Strong	Weak

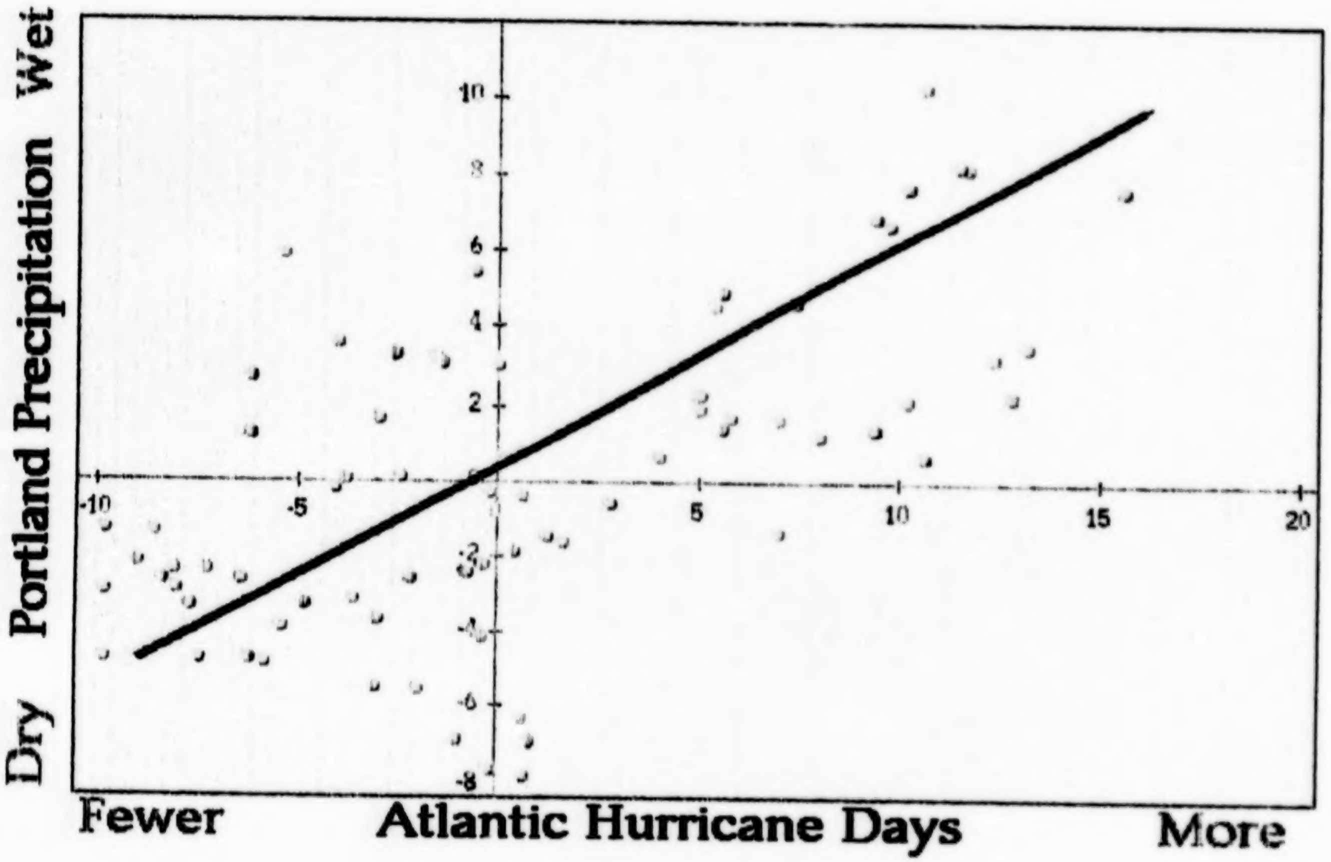


Fig 5

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SUMMARY

LT590	
TEMPERATURE SUMMARY	
	1999
START DATE	7/15/1999
END DATE	9/28/1999
DATA DAYS	76
7 Day Avg Max > 15 °C, 1/1 to 12/30	47
7 Day Avg Max > 17.8 °C, 1/1 to 12/30	12
7 Day Avg Max > 12.8 °C, 1/1 to 12/30	70
MONTHLY MAX TEMPERATURES	
January	
February	
March	
April	
May	
June	
July	18.26
August	18.74
September	15.39
October	
November	
December	
MAXIMUM 7-DAY AVG MAX	18.2

END

DATE FILMED

1 / 3 /05